



## Space for the Digital Age

Defining, designing and evaluation a new world class media centre

Jensen, Per Anker

*Publication date:*  
2007

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*

Jensen, P. A. (2007). *Space for the Digital Age: Defining, designing and evaluation a new world class media centre*. DTU Byg, Danmarks Tekniske Universitet. Research Reports No. R-175

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Per Anker Jensen

## Space for the Digital Age

Defining, designing and evaluating  
a new world class media centre

Rapport  
BYG·DTU  
R-175  
2007

ISSN 1601-2917  
ISBN 97-8877877-250-3



# Space for the Digital Age

Defining, designing and evaluating  
a new world class media centre

Per Anker Jensen

**Department of Civil Engineering**  
**DTU-bygning 118**  
**2800 Kgs. Lyngby**  
<http://www.byg.dtu.dk>

2007



<b>LIST OF CONTENT</b>	<b>Page</b>
<b>List of content</b>	<b>3</b>
<b>Abbreviations and special names</b>	<b>4</b>
<b>1. INTRODUCTION</b>	<b>5</b>
1.1 Background	5
1.2 Summary	6
<b>2. CONTEXTUAL ASPECTS</b>	<b>9</b>
2.1 Strategies for broadcasting facilities	9
2.2 Defining DR Byen	19
2.3 Briefing and user participation	28
<b>3. DESIGN ASPECTS</b>	<b>37</b>
3.1 Accessibility	37
3.2 Environmental sustainability	43
3.3 Workspaces	50
<b>4. VALUE ASPECTS</b>	<b>59</b>
4.1 Value concepts and value based collaboration	59
4.2 Value triangles in management of building projects	66
<b>5. BUILDING EVALUATION</b>	<b>77</b>
5.1 Manager's evaluation of DR's buildings	77
5.2 Post occupancy evaluation of DR Byen	86
<b>6. FACILITIES MANAGEMENT ASPECTS</b>	<b>95</b>
6.1 The origin and constitution of FM functions in DR	95
6.2 Organizational relationships between FM and core business	104
<b>References</b>	<b>113</b>

## **Abbreviations and special names**

Distriktshusene	DR's regional radio centres in province towns
DR	Danish Broadcasting Corporation
DR Byen	DR's new media centre in Copenhagen (DR Town)
FM	Facilities Management
IT-ICO	IT intensive ecological buildings (EU programme)
POE	Post Occupancy Evaluation
Radiohuset	DR's former radio centre (Radio House)
R/TV-huset	DR's provincial centre for radio and TV in Århus, Jutland
Stærekassen	DR's first building (nicknamed Bird's Nest)
TV-byen	DR's former television centre (TV Town)
Ørestad	New developing area in Copenhagen where DR Byen is placed

# **1. INTRODUCTION**

This report includes a collection of research material concerning the buildings occupied by the Danish Broadcasting Corporation (DR) with main focus on the new media centre DR Byen in Copenhagen. This new media centre has been developed as a state-of-the-art broadcasting facility with fully digital multimedia production and a creative and sustainable work environment. The vision has been to create a world class media centre.

The research explores how DR's need for space has changed over time related to the development of the corporation, uncovers how the new facility was defined, investigates some of the main design considerations, analyzes the values applied in the design and construction processes, evaluates the buildings after occupation and looks into the organization of Facilities Management (FM) in relation to core business.

Most of the material has been published earlier in other versions in Danish and/or in English in various research reports and papers for conferences and research symposiums. Most of the 12 sections in chapter 2-6 have been individual papers or case studies written at different times. They have been kept in a form, where they mostly can be read on their own. However, unnecessary repeats of presentations of DR and DR Byen have been reduced to a minimum, and it is recommended to read section 2.1 and 2.2 before later sections.

The purpose of this publication is to provide a coherent presentation of the research on DR's buildings in English. The target groups are researchers and students in the fields of building planning and FM, as well as architects and engineers involved in briefing, designing, constructing and operating complex facilities.

## **1.1 Background**

This research has a very personal background, as I, the author, for almost 14 years was employed by DR as building engineer. In 1991 I started in DR's real estate department as project and facilities manager, and from 1999 until 2004 I was deputy project director in DR's client organization for the building project DR Byen with responsibility for briefing, design coordination, FM planning, signage and landscaping.

Therefore, the research is partly based on personal experience and can be seen as a kind of participatory action research. There may be aspects of the research that do not live up to conventional requirements to objectivity, but the research has on the other hand benefited from an in depth knowledge of the activities and the considerations behind them. The results are evaluations, reflections and presentation of various processes, which others can learn from. More traditional research methods have been implemented as well, including literature and archive studies, interviews and a questionnaire survey. In each chapter the particular methods for the research presented are explained.



## 1.2 Summary

Chapter 2 concerns contextual aspects in relation to DR Byen. The chapter includes three sections, and section 2.1 is a longitudinal study of the space strategies implemented by DR from the start in 1925. It is analyzed how three space strategies – incrementalism, standardization and value based strategy - have been implemented in different periods, and how these strategies can be related to the strategic uncertainty of the corporation. Seven distinct periods are identified with a change between incrementalism and value based strategy except for one period with standardization. Each of the three periods with a value based strategy involved a major new building project - with DR Byen as the latest - and each of those projects were characterized by the presence of a visionary project champion.

Section 2.2 is about defining the overall requirements for the extremely large building project (approx. 130.000 m<sup>2</sup>) and presents the specific background for and general information about DR Byen. The intentions and the vision for the project are explained together with the strategies for the project management, architectural competitions and contracts with the design teams. After a master plan competition the whole building complex was divided in four segments and after the following three more architectural competitions four design teams got involved with designing each their segment.

Section 2.3 focuses on the processes of briefing and user participation during the planning of DR Byen. The concept of continuous briefing is introduced to describe the approach to briefing in DR Byen. Briefing is not just about specifying needs as requirements, but also about evaluating how well design proposals fulfil the needs and aspirations. Furthermore, briefing is not only about building design, but includes processes from the pre-project stage until occupation of the building. A building project like DR Byen is part of a change process of the organization that is going to occupy the building, and it is important to manage the participation of the coming users in the process in an appropriate way.

Chapter 3 concerns design aspects of DR Byen. The first of three sections is about accessibility with particular focus on access for the disabled. Considerations for the disabled have become increasingly important in most countries, and the requirements and recommendations vary from country to country. In Denmark a Danish Standard (DS 3028) with detailed recommendations on accessibility was issued in 2001. The section describes and evaluates the way these recommendations were put into action in DR Byen. It was found necessary to involve a specialist consultant in relation to accessibility on the client side to ensure that the design teams fulfilled the requirements.

Section 3.2 is about environmental sustainability in the design of DR Byen. Environmental sustainability was a concern for DR's top management from the beginning, and a policy was defined at an early stage. DR Byen has received support from the EU as an IT intensive, ecological building (IT-ECO) with ground water cooling, solar panels and intelligent double facades. The effects of these measures will be documented and DR Byen will serve as a demonstration project in relation to sustainability. Avoiding hazardous

substances and emissions from building materials and furniture have been among the other environmental focus points. DR has been awarded several prizes as recognition of the environmental achievements in DR Byen.

Section 3.3 concerns workplace design in DR Byen. From the start it was a contested management decision that DR Byen should be based on open plan solutions. It has been a long process to define more exactly what this means and to get staff acceptance on the decision. A policy group was established to develop principles, guidelines and tools for the workgroups of the interior design. A main result was the definition of furniture modules named my workplace, our workplace and everybody's workplace, and this terminology mirrored the terminology of DR's core business, which had been through a process of profiling TV channels as my channel and our channel. A video was also produced as inspiration for the workgroups.

Chapter 4 concerns value aspects in relation to the design and construction of DR Byen, and includes two sections. The first is about value concepts and value based collaboration. Value has in recent years become a popular term in management theory and practice in general as well as in economic theory and building management. This section attempts to clarify the various uses and meanings of concepts of value/values. The origin and use of value concepts in classic and modern economic theory and in management theory is outlined. Value creation is put in relation to development in products and processes, and a number of design strategies are identified. The concept and methods of value based management and collaboration is discussed based on the experiences from DR Byen.

Section 4.2 is about value triangles in management of building projects. The conventional value triangle of quality, cost and schedule for project management is the starting point, but this is seen as mainly being related to process integrity in the construction stage. It is supplemented by a similar value triangle of cultural value, use value and quality of realization for product integrity, mainly for the design stage. Based on this framework an evaluation is made of the value management in six of DR's building projects from the first around 1930 to the present – DR Byen.

Section 5 concerns building evaluation and includes two sections. Section 5.1 is about managers' evaluation of DR's buildings and presents some of the results from a questionnaire survey among general managers and building managers in DR concerning their evaluation of 5 buildings. The overall purpose of the survey was to evaluate the different buildings' values. Distinctions were made between use value and cultural value and between value as built and over time. Use value has in general higher priority than cultural value, and value as built has higher priority than value over time. Building managers give higher priority to use value than general managers. The implications of such differences for the way building managers communicate with general managers, and how architects approach and collaborate with large corporations is discussed.

Section 5.2 is about the evaluation of DR Byen after occupation and presents some results of an interview survey among managers and staff in DR in spring 2007, when they had worked between 4 and 12 months in the building. The evaluation concerns both the

building as work environment, the involvement in the planning process and the fulfilment of the vision. The situation in DR during the time of the survey was characterized by a crisis due to economical cuts and staff redundancies, but in spite of that there was a general satisfaction with the building and the involvement process. The open plan workspace is still debated, and the evaluation of the fulfilment of the vision was very ambiguous.

Chapter 6 concerns FM in DR and includes two sections. The first is about the origin and constitution of FM functions in DR. The focus is on how the internal functions of building operation and building clients and the related service functions have developed over time to become an integrated corporate FM function. The analysis shows that the building related and service related functions have developed separately for a long period starting at operational level and with the tactical and strategic levels being introduced at later stages, when the organization had grown considerably. Only within the last 20 years have integrations occurred starting with a vertical integration of the operational, tactical and strategic levels separately for the building related and service related functions. Later on a horizontal integration of building related and service related functions takes place and a fully integrated corporate FM function is established.

Section 6.2 is about the organizational relationships between FM and core business. The focus is the organization of FM, when DR Byen is finished and the temporary client organization is abolished. The aim is also to clarify how the relationships with the core business vary for strategic and operational support functions. The value chains for core businesses and support functions are analysed and related to empirical data from DR. A particular support value chain is identified and a typology of archetypes of support functions is developed. The relationship between core business and strategic support is identified as primarily a general business orientation, while the relationship between core business and non-strategic functions is identified as mainly a specific customer orientation. It is concluded that a market relationship – internally or externally – is appropriate for non-strategic functions, while it is important to create a kind of coalition between the core business and the strategic support function.

## **2. CONTEXTUAL ASPECTS**

This chapter on contextual aspects in relation to DR Byen includes 3 sections.

Section 2.1 on strategies for broadcasting facilities is based on chapter 2 in the research report “Real Estate Strategies and Building Value” written in Danish (Jensen, 2006d). A paper with the title “Strategy and Space for Broadcasting Facilities – A Longitudinal Case Study” was presented and published in proceedings from an international symposium on Facilities Management and Maintenance in Trondheim in June 2006 (Jensen, 2006c). The text presented here has been adjusted and updated.

Section 2.2 on defining DR Byen is a general presentation of the building project with main focus on the initial intentions and the strategic considerations about managing and organizing the project. The first part of the presentation resembles a paper with the title “Planning Broadcasting Facilities for the 21<sup>st</sup> Century”, which was presented and published in proceedings from the conference World Workplace Europe in Innsbruck in June 2001 (Jensen, 2001). However, a major update has been made in the present text.

Section 2.3 on briefing and user participation is a very extended version of a paper with the title “Continuous Briefing and User Participation in Building Projects”, which was presented and published in proceedings from the international conference Adaptables in Eindhoven in July 2006 (Jensen, 2006b).

### **2.1 Strategies for Broadcasting Facilities**

This section deals with space strategies – or corporate real estate strategies - understood as strategies for managing the capacity and quality of building space needed for the development of an organization. Real estate strategies in relation to commercial property are not covered. Space strategy is regarded as an integrated part of strategic Facilities Management.

The basic theoretical questions in this paper are to identify the main drivers for development and changes in space strategies and how to categorize different space strategies. These questions are investigated in literature studies and the results are tested in a case study of the space provision for DR during the 80 years of the corporation’s existence. Based on empirical research the development of DR is divided into 7 distinct periods with different space strategies and partly based on differences in the strategic uncertainty. Furthermore, it is analyzed how the space strategies deals with adaptability in varying ways in different periods.

The research is part of an ongoing project on space strategies and building values, which involves a major case study of the development of facilities for DR. The paper starts with a description of the research methods applied and the purposes of the research, followed by a presentation of theory on space strategies. Afterward the case study is presented as

well as the major findings in relation to space strategies and finally conclusions are drawn.

### **Research methods and purposes**

The data collected in the research project are partly based on interviews and a small questionnaire survey, but the results presented in this paper are mainly based on literature studies and archive research. The literature studies has both been of a theoretical nature related to space strategies in literature on facilities management and of empirical nature with focus on the development of space provision in DR. The archive studies have supplemented the empirical literature studies and have include studies of archives at DR's internal library and archive as well as archives on some of DR's major building projects at the Danish National Archive (Rigsarkivet).

As part of the research all annual reports from DR have been studied and timelines of quantitative data like development in annual number of broadcasting hours of radio and television, expenditure and number of staff have been established. The development in DR is analyzed in relation to international development in broadcasting and the general development in society during the same historical period.

In this paper the case study is on one hand used to test the theory of space strategies. On the other hand the case study is used together with the theory to get a deeper understanding of the development in DR's space provision. The research aims to contribute to the development of theory on space strategy mainly by providing an increased empirical foundation. Furthermore, the research attempts to provide an exemplary way to study space provision to create more consciousness about the importance and conditions for space strategies among facilities managers.

### **Theory on space strategies**

A space strategy will always be based on some presumptions or policies, for instance whether a company prefers to own or rent their facilities. Both policies and strategies can be explicitly expressed or implicit, but in either case the practical management and decisions on space will be an indication of specific policies and a certain strategy. The need to explicitly express policies and strategies of space is related to the strategic importance of space in a specific situation and time period.

Barrett & Baldry (2003) discuss the difference between strategic and operational decisions. They develop a diagnostic checklist according to which a problem is strategic if most of the following criteria are fulfilled: The problem occurrences are rare, the consequences are radical, serious, widespread, long-lasting and precursive with many parties involved.

It is characteristic for space provision that most companies only occasionally make major decisions. According to O'Mara (1999) they take place in average every 3-5 years in bigger American companies. Such decisions mainly occur when new building projects are initiated, buildings are going to be bought or sold or major rental arrangements started or ended. In these situations the strategic importance of space decisions is obvious, because

the decisions will have serious long-term consequences on the companies' economy and possibilities to develop with great side effects on staff and collaborating partners. Between such decisions space is important as a physical frame for the company and responsible for considerable expenses, but it does not necessarily need much ongoing attention among the top management of the company. Space is usually just taken for granted.

Therefore it is relevant to distinguish between generic strategic areas and current strategic areas (Jensen, 2004). Generic strategic areas are generally of great importance for the long-term development of the company, but they do not necessarily require much ongoing attention from the top management. Current strategic areas are areas where specific internal or external developments make it necessary to frequently make critical decisions of importance for the company's long-term development. Space is characterized as a generic strategic area, which occasionally becomes a current strategic area for the top management of companies. In comparison areas like product development and market position have a more constant need for attention from top management as they are of great importance for companies' income.

The most important aspect of space strategy is to ensure the long-term adaptation of space to companies' need for development. Space strategies enable competitive advantages by supplying the right resources in the right place at the right time at the right cost. Real estate and facilities fulfill two critical roles; the first role is to physically support the production process and the second role is the symbolic representation of the organization to the world. O'Mara (1999) defines three generic space strategies based on analyses of space provision in more than 40 American companies: Incrementalism, standardization and value-based strategy. The strategies are mainly dependent on the companies' strategic uncertainty about their future development.

Incrementalism means that adaptations of space are made only in small steps when absolutely necessary and extra space is usually rented to avoid major capital investments. This strategy is mainly applied by companies under great uncertainty, which is typical for new companies in the start-up stage, where the demand for the companies' products is impossible to predict. The strategy can also be applied by companies under fast growth, where acquiring extra space rapidly, when needed, has high priority. In markets with rapid economical or technological changes or general great uncertainty this strategy is also often used.

Standardization means that both design and decisions on space are strongly regulated and based on strict long term plans. This strategy is mainly applied by companies under low uncertainty. This is typically large companies with a well consolidated position in a relatively stable or expanding market and often with distributed localization. The strategy often involves standardization of both design processes and design outcome.

Value-based strategy means that the symbols and values of the organization play an important role in decisions on space. This strategy is mainly applied by companies under medium uncertainty. This is typically companies that use building projects to promote their position both by creating optimal physical frames for production processes and by

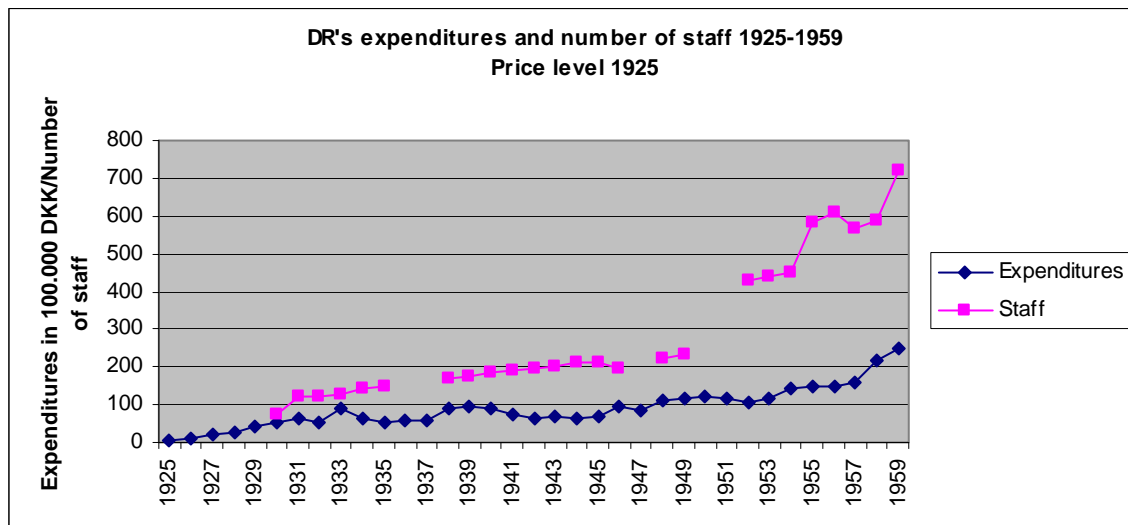
utilizing the buildings as a symbol in relation to the surrounding world. It can be relative new companies that have reached a level of increased certainty about the future and a need to make this manifest. Also companies which have survived a major crisis period or companies with a new management who wants to create and signal major changes will often apply a value-based strategy.

A company's strategic uncertainty can according to O'Mara be analyzed from the following factors in the surroundings: Finance, competition, customers, suppliers, politics and technology.

### Case study findings

DR was established in 1925 as a state institution with monopoly in Denmark on radio broadcasting. In the 1950's television was added and DR kept the monopoly on nationwide television broadcasting until 1988. From the beginning DR was financed fully by license fees and this is still the main income. DR is not allowed income from commercial adverts. The political control of DR has always been strong although there has been a change towards more independence, particularly after losing the monopoly status. Until then DR's budget was decided annually by the government while the budget and other conditions are now decided for periods of 3-4 years.

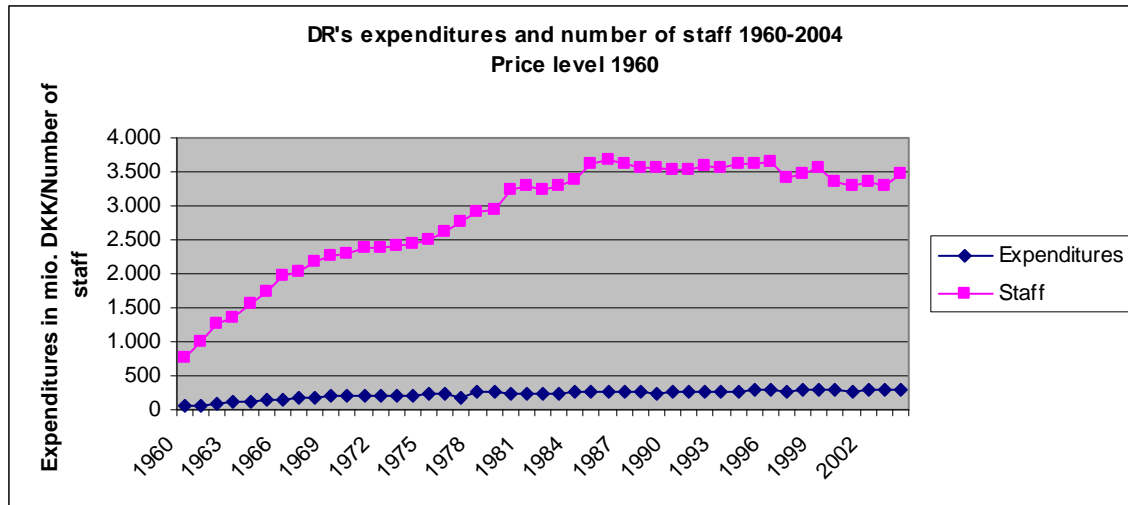
The overall development in DR over time is illustrated by the annual expenditure and number of staff from 1925 to 1959 in figure 2.1.1 and from 1960 to 2004 in figure 2.1.2. Expenditures are indexed to price level 1925 and 1960, respectively, and the scale for expenditure is 100,000 DKK in figure 2.1.1 and million DKK in figure 2.1.1.



**Figure 2.1.1** DR's expenditure and staff 1925-1959 (Jensen, 2006)

Figure 2.1.1 shows a gradual increase in both expenditure and staff from the beginning, but with strongest increase in staff. The sudden increase in staff around 1950 was caused

by transfer of technical staff working for DR from P&T (Danish Post and Telegraph Corporation). During the 1950's the increased became more rapid both for staff and expenditures increased even more due to the start of television and a second radio channel.



**Figure 2.1.2** DR's expenditure and staff 1960-2004 (Jensen, 2006)

Figure 2.1.2 shows that the number of staff exploded from the start of the 1960's and continued to increase rapidly due to the strong development of television and more radio channels and continued to increase until the end of monopoly in 1988. After that the number of staff has been fairly stable with a slight downward trend due to rationalization and outsourcing. The expenditures increased during the 1960's and 1970's but very slight compared to the increase in staff and since 1980 the annual expenditures have been also the same in fixed prices.

DR has mainly been located in purpose designed buildings financed by the annual income from license fees. DR has in general not been allowed to take out mortgages or other kinds of loans without special permission from the government. The current project of building a new headquarters in Copenhagen (DR BYEN) is the first building project, which is mainly financed by state guaranteed loans.

The analysis of DR's general development, the strategic uncertainty and space provision has resulted in a division of 7 periods characterized by different space strategies. This is explained below through a description of each period.

#### *Incrementalism during the early years of radio 1925-1933*

During the early years the uncertainty about DR's future was very great both in relation to finance, customers, politics and technology. Only in relation to competitors was there no immediate uncertainty because of the monopoly – except for foreign radio stations but none of these broadcasted in Danish. The first year was a test year and DR just managed to get the prospected income from license fees, but DR quickly turned into a big success



with many more listeners and higher income than expected. The organization expanded quickly and invested heavily in new technology for production and transmission to increase the quality of broadcasting.

Initially DR took over existing production facilities with a radio studio and technical equipment at a P&T building in Copenhagen. Offices facilities were placed subsequently in two different buildings around Copenhagen during the first year before they could be situated close to the production facilities by the end of 1926. In 1928 all of DR moved to a rented place, where improved studio facilities were established including the worlds first radio concert studio with audience.

However, before DR's move the Danish minister of public works, who was responsible for DR, had decided to build an extension to the Danish Royal Theater with a new theater hall but including space for DR and based on DR being the owner of the building and renting out the theater hall. This was clearly a way to economically support the Royal Theater by DR's steadily increasing income from license fees, but DR had to accept this solution.

The new extension - nick-named Stærekassen (nest box) - was finished with delays in 1931, but already during construction it became clear that the architect had not implemented promised measures for sound insulation between the theater hall and DR's radio studios. In the meantime DR's organization had expanded rapidly, and therefore the new building did not provide enough space, so DR had to rent office space in a neighboring building and keep on renting the concert studio. Furthermore, after only two years the Royal Theater could no longer afford to rent the theater hall, and DR was forced to take it over without it being really useful for radio production. The case was all together a big scandal, and when DR's board required permission to develop a new purpose designed building it took an expert inquiry to convince the minister that it was justified.

The space strategy in the early years of radio from 1925 to 1933 was clearly an incremental strategy with several changes in space provision to accommodate the needs of a rapidly expanding organization and with some expensive learning experiences.

#### *Value-based strategy during the building of Radiohuset 1934-1945*

The decision to build a purpose designed building for DR marked the change to a value-based strategy. DR had proven successful and the uncertainty in relation to finance, customers and politics had been greatly reduced. The production and transmission network had been developed and the quality of broadcasting had been raised, but the technology was still developing fast and the science of acoustics was still very young.

Thus, the uncertainty in relation to technology was still high, and this may be partly the reason why engineer Kay Christiansen from P&T became in charge of the new building project. He was the one who by chance discovered the problems with lacking sound insulation during the construction of Stærekassen and he had written the report that convinced the board of DR, that Stærekassen was unsuitable for DR's further development. He managed to get free hands to select a team with an architect, a structural engineer and an

installation engineer – the technical committee – who jointly developed the project proposal for the new building, Radiohuset (Radio house), in 1934. After a reduction of the project, partly by no longer preparing for television, a revised proposal including a concert hall was approved early 1936.

The technological uncertainty was reduced by several study tours to other radio buildings in Europe and during design a number of technical experiments were conducted, mainly in relation to acoustics and sound insulation. An acoustic test facility was established on the building site as part of bomb shelters constructed for the building.

The building was for most parts finished in autumn 1940 after the German occupation 9. April 1940, but the concert hall was purposefully drawn out not to be finished before the end of the war in 1945 to avoid it being used for propaganda by the occupation force. The national cultural importance of the building was clearly expressed at a meeting of the building committee in discussions on artistic decoration by the head of DR's board Julius Bomholt – social-democratic member of the Danish parliament and later minister in several periods for among other things culture - in 1941: "a building that should serve all our popular cultural life. It was a building for the whole population. From it would come influences into every home in the country. The work to be taken place in the building should serve to maintain our national identity and our Danish heritage into the future." (Jensen, 2006 - my translation).

#### *Incrementalism during the early years of television 1946-1958*

During the war radio broadcasting had been reduced and the first years after was a period of reconsolidation. This was soon changed to a new expansion and new developments by the beginning of television transmissions and launching a second radio channel in 1951 followed by establishment of new transmission networks for television and FM radio.

This created need for more space and the head of television J.Fr. Lawaetz published a book where he described his visions for television house in Utopia. However, he realized that this was a long term goal and he wrote: "But do not believe, that we dream about building a house, we would not dare do that even if we had the money. First we need to gain lots of experiences. The best thing would be, if we when time is due could find an existing building that without too great changes could be made into a temporary television house." (Lawaetz, 1951 – my translation). An incremental strategy could not be expressed much clearer. The first years of television were on an experimental basis with only a few hours of transmission per week, and the political uncertainty was great until 1954, when permanent permission for television was granted.

A plan for renting a specific building for a temporary television building was proposed in DR but it was not approved. Instead it was decided to make an extension to Radiohuset. DR's board decided as early as 1948 to have a project proposal for such an extension produced by the architect of Radiohuset but due to the post-war situation with national monetary problems and lack of building materials etc. permission for the new building project was not given before 1953 and it was finished in 1958. In the meantime space for

television had to be found in the existing building including changing a former radio studio into a television studio and renting space for a film studio externally.

*Value-based strategy and incrementalism during fast-growth 1959-1972*

It soon became clear that the extension of Radiohuset was insufficient to accommodate the expanding needs for both radio and television, and the new media television was regarded by the radio staff as a cuckoo that had taken over their nest. In 1956 DR's board decided it was time to find a site appropriate for a separate television house and in 1959 an architectural competition was arranged. Instead of a house the development became much bigger and was called TV-byen (TV town). It is placed in Gladsaxe 10 km north of Copenhagen and was developed in stages from 1959 to 1981 as a 100,000 m<sup>2</sup> complex.

The brief for the architectural competition described a project in two stages about the size of the extended Radiohus but the result turned out to be 4 stages with three times as much space. In the brief the possibilities to make extensions of all main functions – workshops, studios, technical facilities and offices - was stressed and the winning project was based on bands for the different functions held together by a central joining corridor system, where each band had space for expansions with more buildings. The buildings are on one to three floors except for a 15 storey high-rise office building, which express the grandness of the development and the importance of television as a media.

The strategic uncertainty about television was reduced when the development of TV-byen began. The transmission network was developed nationwide and the number of viewers paying a special television license fee on top of the radio license fee was steadily increasing. In a new law from 1959 television became officially a part of DR's broadcasting, so the political uncertainty was low. However, the technological development within television was rapid and created uncertainty for the building planning and caused changes in the layout. The technical center was originally planned for only one channel and black and white television. This was later changed and an extra technical building was added to allow for two channels and colour television. The latter was introduced in the last 1960's, but a second channel was not introduced before the mid 1990's. At that time the old facilities were outdated and another new building was added.

The office spaces in TV-byen were designed with a strong focus on flexibility in relation to being able to move and reuse walls between offices and create offices of varying sizes for various numbers of workplaces. Ceilings and services are prepared for walls for each facade column,

The explosive expansion of television broadcasting and staff during the 1960's forced DR to complement the value-based strategy for development of TV-byen by an incremental strategy including renting several places around Copenhagen and building temporary pavilion buildings in TV-byen. Around 1960 started regional radio a few hours per week from a number of district radio stations around the countries, and this was also supported by an incremental strategy renting places around Denmark and later on developing new buildings for district radio stations.

### *Standardization during continued expansion 1973-1983*

The developments of Radiohuset and the first stages of TV-byen were managed by political building committees with many members from DR's management, DR's board, the Danish parliament and building specialists. In 1970 DR appointed one of the engineers – Poul Højmark - with experience from TV-byen as building coordinator. He became DR's first professional internal building client.

Around the end of 1960's the political control over DR was under debate as television had become a very powerful media, but a new law from 1973 secured a higher degree of independence of DR's economy. The explosive expansion of the 1960's had changed into a more moderate growth but DR's license fees were still increasing from a higher colour television license fee. In this situation the space strategy changed to standardization.

This was clearly expressed by the last stage of TV-byen, which consists of small modular building blocks with one to two floors joined together by corridor systems. This building system was first used for the television news department in a building with 8 modular blocks. While these were being built it was decided to copy the system with another new building covering 3 modular blocks for other departments placed in another part of TV-byen. Around the same time it was decided to build 3 similar radio district buildings in three towns in Denmark as standard buildings. This was based on experiences from another new radio district building which was used as a test project for developing the standard building type.

### *Incrementalism around the end of monopoly 1984-1998*

In 1983 a parliamentary commission on media recommended that an independent television station should be established in Denmark to create competition to DR. Although DR's monopoly continued to 1988 it immediately increased the political uncertainty for DR and when the monopoly stopped the political uncertainty was substituted by a serious uncertainty from competitors – not only from the new Danish TV-2 but increasingly also from other Danish and international commercial television broadcasting via satellite transmission. DR's market share gradually went down until the mid 1990's, when the new General Director, Christian Nissen, managed to consolidate and improve the position, among other things by launching the new television channel DR-2.

In this period the space strategy again became incremental with only a few small new buildings and main focus on consolidating DR's space in the main centers TV-byen, Radiohuset and R/TV-huset in Århus. In the process several rented spaces were finalized and also some owned facilities were sold. For the first time an explicit space strategy was formulated in DR.

### *Value-based strategy during relocation to DR BYEN 1999-*

The consolidated market position for DR's television reduced to some degree the uncertainty in relation to finance, competitors and politics, but reduced uncertainty is hardly sufficient to explain why DR decided in 1999 to relocate all functions in Copenhagen to a new headquarters building in Copenhagen called DR BYEN.

The reason was that political opportunities suddenly occurred as the Danish state had started a huge development project in Copenhagen by building a new metro that was planned to be finance partly by developing and selling of land in an area called Ørestad, including former military areas close to the city. The cost of the metro project escalated and the selling of land went very slowly. A big public institution like DR moving to this new development could give a strong impetus to the development. Christian Nissen saw this as an opportunity to transform DR to a new culture with new multi-media production and completely digital technology.

This decision is a clear indication of a value-based strategy and the involvement of the famous French architect Jean Nouvel as architect on a prestigious concert hall gives further evidence to this. When DR moves in to this new headquarters the space strategy is likely to again become incremental for a long period.

DR BYEN is in contrast to TV-byen a very compact complex of 130,000 m<sup>2</sup>. It is organized with four buildings joined together by a grand internal street and with mixed functions in each of the buildings. It is almost impossible to extend the buildings, but it is possible for DR to built new building on the other side of a metro high-rail. The internal adaptability is based on open office spaces with great generality.

## **Conclusion**

The space strategies used by DR during it's 80 years history shift from periods with incremental strategies and periods with value-based strategies. During the 1960's with explosive expansion a value-based strategy is complemented by an incremental strategy to accommodate the rapid developing need for space. That period is for the only time followed by a period with a standardization strategy. This occurs alongside DR establishing the first professional building client function. The seven periods vary between 9 and 15 years with an average about 12 years. The development is summarized in table 2.1.1.

The theory formulated by O'Mara (1999) is regarded to provide a suitable frame for investigating and analyzing space strategies. The concept of strategic uncertainty can be used to explain most reasons behind and changes in space strategies. It is characteristic that DR's space strategies mainly have been influenced by changes in political and technological uncertainty, and the uncertainty was largest in the early years of radio and of television and around the end of monopoly when uncertainty from competitors also became important. Rapid expansion has also shown to be an important factor in the 1960's, and the political opportunity and managerial desire to make major changes in DR are factors necessary to explain the current relocation of DR.

The views on adaptability has changed dramatically in DR from TV-byen in the 1960's to the present development of DR BYEN from main focus on possibility to expand, functional specialized buildings and flexibility in moving office walls towards less focus on the possibility of expansion and main focus on functional integration and generality of office spaces.

Space strategy	Period	Main development	Main buildings
Incrementalism	1925-33	Early years of radio	Stærekassen ("The Birds Nest")
Value-based	1934-45	Golden years of radio and WW2	Original Radiohus
Incrementalism	1946-58	Rebuilding after WW2 and early years of TV	Radiohus extension
Value-based and Incrementalism	1959-72	Explosive growth of TV and regional development	TV-byen phase 1-2, R/TV-hus phase 1
Standardization	1973-83	Increased independence and reduced growth	TV-byen phase 3-4, R/TV-hus phase 2-3, districts
Incrementalism	1984-98	End of monopoly, stagnation and consolidation	None
Value-based	1999-	Digitalisation and multi-mediality	DR Byen

**Table 2.1.1** DR's space strategies in 7 periods

It is characteristic that periods with value-based strategy has involved developing a major new building complex. Furthermore, in each case one person has been leading the process with defining the vision and overall intentions with the development. In the 1930's engineer Kay Christiansen was leading the development of Radiohuset, in the 1960's television director J. Fr. Lawaetz was leading the development of TV-byen and recently General Director Christian Nissen has been leading the development of DR BYEN. There seems to be a clear connection between a value-based strategy and a visionary person leading a major project as a "champion".

## 2.2 Defining DR Byen

DR is a purely license-financed independent public institution. DR was established in 1925 and was until 1987 the only national broadcasting company in Denmark. DR has the "public service" duty to provide an all-round quality output of programmes for all age and social groups.

DR is the biggest electronic provider in Denmark of news, information, Danish music and Danish drama etc. In addition, DR has a Radio Symphony Orchestra, a Radio Entertainment Orchestra, a Jazz Big Band and the classical Danish National Radio Choir and the DR Girl Choir.

DR's programme output is currently organized as follows:

- DR Radio comprises four FM channels and one of these is broadcasting regional radio services from nine regions. DR Radio also broadcasts a huge number of digital radio channels. DR's market share for radio broadcasting is approximately 2/3.

- DR TV has two channels: DR 1 and DR 2. DR's market share for television broadcasting is approximately 1/3.
- DR Online ([www.dr.dk](http://www.dr.dk)) is the country's biggest Internet news provider
- R Multimedia produces merchandise related to DR Radio, DR TV and DR Online.

DR currently employs approximately 3,500 people and around 3,000 works in the Greater Copenhagen area.

DR in the Greater Copenhagen area was before the relocation to DR Byen split between 12 addresses with the majority placed at the main centres, Television Centre (TV-byen) in Gladsaxe 10 km north of central Copenhagen and Radio House (Radiohuset) with its Concert Hall in Frederiksberg close to central Copenhagen. Outside the Greater Copenhagen area there are eight regional radio stations and the provincial Television Centre in Århus.

On 1 June 1999 DR's board decided that DR's activities in the Greater Copenhagen area should be relocated and moved to new headquarters in Ørestad. It had been considered to base the development on a lease-contract or a BOOT-contract (Build-Own-Operate-Transfer) with a consortium consisting of a contractor and an investor, but it was finally decided that DR should itself build and finance the new headquarters. In August 1999 the Danish parliament's finance committee accepted – with the smallest possible majority - that DR should finance the project by income from sale of DR-owned facilities and international loans with state guarantee.

The aim of gathering DR's operations in the Greater Copenhagen area at one address is to establish optimal conditions for the multimedia production of the future, based on new technology and new team working practices. More specific the background can be summarized as follows:

- New digital technology: Computer based editing of sound and video, virtual TV etc.
- New division of labour: Major parts of technical editing tasks taken over by non-technicians (journalists etc.)
- New products: On-line services, multimedia, on-demand programmes etc.
- New organizations: Integration of Radio and TV (bimedial) and On-line (trimedial) and New Media (multimedial)

### **The Øresund Region and Ørestad**

On 1 July 2000 a new bridge and tunnel connection for cars and trains was opened across Øresund between Sweden and Denmark. In Sweden the connection is placed near Malmö and in Denmark it is placed near the Copenhagen Airport in Kastrup on the island of Amager. Copenhagen is placed by harbours spreading out along both sides of a small stretch of water between Zealand (Sjælland) and Amager, with several bridges connecting the two islands.

The bridge and tunnel connection between Sweden and Denmark is expected to have an immense impact on the development on both sides. It will unite southern Sweden with

the Greater Copenhagen area creating a new cross-national region - The Øresund Region – which is foreseen to be a regional growth centre in the Scandinavian and Baltic area. Together with the bridge and tunnel connection a new motorway and a new train line have been established, and the Copenhagen Airport has been modernized with large increase in capacity.

Just five years earlier the west of Zealand was connected by another new bridge and tunnel connection for cars and trains across the Great Belt (Storebælt) to the island Funen (Fyn), which is connected to Jutland (Jylland) and the European continent. Therefore, all of Scandinavia is now connected with the European mainland.

Ørestad has been developed alongside and in accordance with the overall plans for the Øresund region. Ørestad is placed within the municipality of Copenhagen on the island Amager - partly on former military areas. The northern part – Ørestad Nord – where DR is going to be located is close to central Copenhagen. The neighbours to DR will be new developments for the University of Copenhagen on Amager, IT University of Copenhagen and IT Research Park, the Danish National Archives, and housing.

The overall development of Ørestad is undertaken by the Ørestad Development Corporation (ØSS - Ørestadsselskabet A/S, web-site: [www.orestad.dk](http://www.orestad.dk)), which has been established under a special law by the Danish parliament as an independent company with the Danish state and the municipality of Copenhagen as share holders. The overall idea is that ØSS shall construct and operate a new metro in Copenhagen as well as develop and sell the land in Ørestad, so that income from sale of land can finance the cost of establishing the metro.

The intention with Ørestad is to avoid the creation of a new suburb but to develop new, attractive city developments with a mixture of different functions: Offices, cultural institutions, shopping, entertainment and housing. Besides the metro, which will connect the different parts of Ørestad and provide attractive transport service, major features are the incorporation of a number of artificial canals and access to the preserved natural areas (Amager Fælled) on the west side of the development.

### **Requirements to the building project**

DR's building project was planned with 105,000 m<sup>2</sup> gross area above ground and 25,000 m<sup>2</sup> basement.

DR defined the following overall intentions for the building project:

- A physical concentration of activities.
- Editorial and technical integration between radio, TV and Online from research through programme production into presentation of the different products in the three media.
- A highly efficient digital multimedia building, which must offer the optimal flexibility in terms of fitting-out, options to realize new production and working practices



and have room for an organizational change of editorial staff and groups to suit changing programme outputs etc.

- Flexible studio facilities, which on TV side give the options of both virtual studio development and traditional studio production, and on radio side have flexible facilities for radio work both in traditional studios and from editorial areas, while, simultaneously, a number of studio facilities can be used for both TV and radio.
- Open editorial areas with various types of workplaces and informal meeting places as well as associated quiet rooms, meeting rooms, archives, "touch-down" areas and cafés/eating areas with easy access to production facilities.
- An environment with exciting surroundings and a pleasant indoor climate, which inspires creative development of ideas, visible learning processes and informal co-operation.
- A building made of environmentally friendly materials and resource-conserving structures and systems, so that the building incorporates the latest well-tried technology and expertise within environmental and building ecology
- A complex that forms an active unit in a lively quarter with open relationships with neighbouring buildings in Ørestad and the surrounding landscape, and which, through a striking architectural appearance, contributes to supporting DR's image as Denmark's most important provider of quality media output to the whole population.

The space programme for the whole complex was specified as shown in table 2.2.1.

Function	Net Area
<b>A. Main Functions:</b>	
A.1 Music Editorial and Concert Hall	12,100 m <sup>2</sup>
A.2 Other Programme Editorial	18,500 m <sup>2</sup>
A.3 Common Studio Facilities	5,700 m <sup>2</sup>
A.4 Master Control and Continuity	1,200 m <sup>2</sup>
A.5 Management, Administration and Chief Editorial	7,900 m <sup>2</sup>
<b>B. Support Functions:</b>	
B.1 Production	10,500 m <sup>2</sup>
B.2 Internal Services	2,800 m <sup>2</sup>
B.3 Technical Services	1,800 m <sup>2</sup>
B.4 Technological Development	2,300 m <sup>2</sup>
B.5 Garages	3,300 m <sup>2</sup>
B.6 Building Services	1,500 m <sup>2</sup>
<b>C. Special Functions:</b>	
C.1 DR Shop, Displays etc.	700 m <sup>2</sup>
C.2 Various Restaurants, Cafés, Shops, Kiosks	1,500 m <sup>2</sup>
<b>Total Net Area, excluding basement</b>	<b>69,800 m<sup>2</sup></b>

**Table 2.2.1** Space programme for DR Byen

The space programme did not include storage space etc. in basement. The building is planned with basement under all buildings. In addition, the project also involves the establishment of a satellite dishes park, which has been established on the roof.

### **Initial organization**

The first organizational step in DR, in relation to the building project, was to establish a small dedicated unit working solely with this project. DR has not undertaken major new building projects since around 1980, but it did have a small highly qualified real estate department and the new unit – DR Ørestad Project - was established by staff from that department.

Initially, DR Ørestad Project only consisted of a project director, a deputy project director and a secretary. Later on the unit was enlarged by one person. The unit may be enlarged further, but the intention is to keep DR's internal organization in relation to the building project as small as possible. DR Ørestad Project is placed with direct reference to DR's Resource Director, who is overall responsible for the project.

The first main task was to appoint an external client consultant or Project Manager (PM). The procedure for this included an open EU-tender. The tender procedures were undertaken by DR Ørestad Project with expert assistance from DR's external solicitors with expertise in building law and contracts.

The PM was given overall responsibility for the whole building project, including control of budget and time schedule. It was also required that the PM was qualified at a high level to advise DR and make quality control on project design and construction within all relevant architectural and engineering professional fields, including for instance acoustics and ecology. The high requirements resulted in only a few, but mostly very qualified applicants.

After a thorough evaluation DR decided to appoint COWI A/S – a major Danish engineering consultant company - with a number of sub-consultants as PM. The sub-consultants included the Danish architect firm PLH arkitekter A/S, the international planners and architects DEGW from London, the German environmental engineering specialists DS Plan from Berlin and the Danish acoustic experts Gade and Jordan.

Together with the PM and the external solicitors, DR Ørestad Project put a lot of considerations and efforts in the development of competition and tender strategies. It was a precondition that DR as a public institution should carry out an architectural competition. Therefore, consultations with the Association of Danish Architects (DAL) were undertaken during the decision process.

For DR the following considerations and criteria were important:

- The competition should be able to attract architects internationally
- The competition should with a high degree of certainty give a result, where it was possible to appoint a winner with a project that could be constructed within budget and time schedule
- The project should at the same time have on the one side a coherent and architectural exciting layout, and on the other side the possibility of variation

- The procedure should in particular allow for the concert hall to be of exceptional design and quality
- The project should be manageable without the risk of being completely dependent on one company
- The competition should be able to attract companies of medium size on an international scale to increase competition and to reduce risk of capacity problems

To fulfil or to optimize between these criteria the following five models were considered for the initial architectural competition:

1. A master plan competition only, i.e. the winning architect would not be involved in detailed design, which would have to be subject to one or more design competitions later on. This procedure could make it difficult to attract architects internationally.
2. A master plan and design competition for the whole complex. This procedure would make us completely dependent on one company.
3. A master plan and design competition for the whole complex except for design of the concert hall, which should be subject to a separate competition later on. This procedure was regarded as advantageous compared with model 2.
4. A master plan competition where the winning architect is asked to make detailed design of one segment of the whole complex. This procedure was finally regarded as the best solution.
5. A master plan competition with three winning architects, where each of these are asked to make detailed design of a segment of the whole complex based on the preferred master plan. This procedure was regarded as legally untested in relation to EU tender regulations and therefore risky.

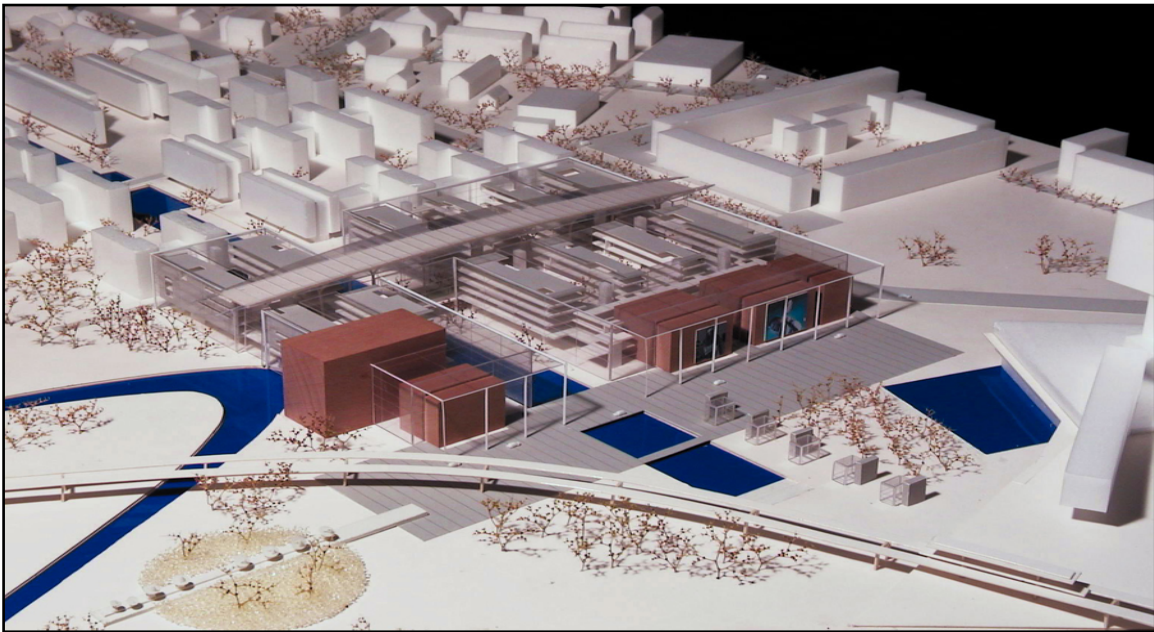
As mentioned above, model 4 was chosen, and it was decided that the master plan should divide the whole complex into 3-6 segments.

Another important issue in relation to the initial competition was whether it should only involve architects or consortiums of both architects and engineers. A main argument for a consortium was the emphasis on integrating environmental aspects in the project. On the other hand it was also clear, that architectural issues would be the most decisive factors in the selection between the master plans. Therefore, it was regarded as more important to be able to select the best engineers in a separate competition – not least because the selected engineer would be responsible for designing the overall technical infrastructure and implementing the general environmental concepts. For contractual ease it was decided, that the winning architect and the winning engineer should team up as a design consortium.

### **Design competitions**

The initial competitions took place in year 2000. The architect competition was anonymous with 8 participants equally distributed between foreign and Danish architects. The winner was the Danish architect firm Vilhelm Lauritzen AS, which by coincidence is the same company that has designed almost all former buildings for DR. The winning master plan is shown in figure 2.2.1

The winning master plan had a clear constellation with four segments placed as squares in each corner of a rectangle. The rectangle was divided in east and west by a street for light traffic and an artificial canal running through the development from north to south as part of the general town plan for the area and joined together by a narrow building – the internal street - going from east to west on floor level 2 and passing the street and the canal as a four story high bridge building. The buildings were generally 6 stories high – about 26 m above ground - with full basement, but the concert hall in segment 4 could be as high as 45 m.



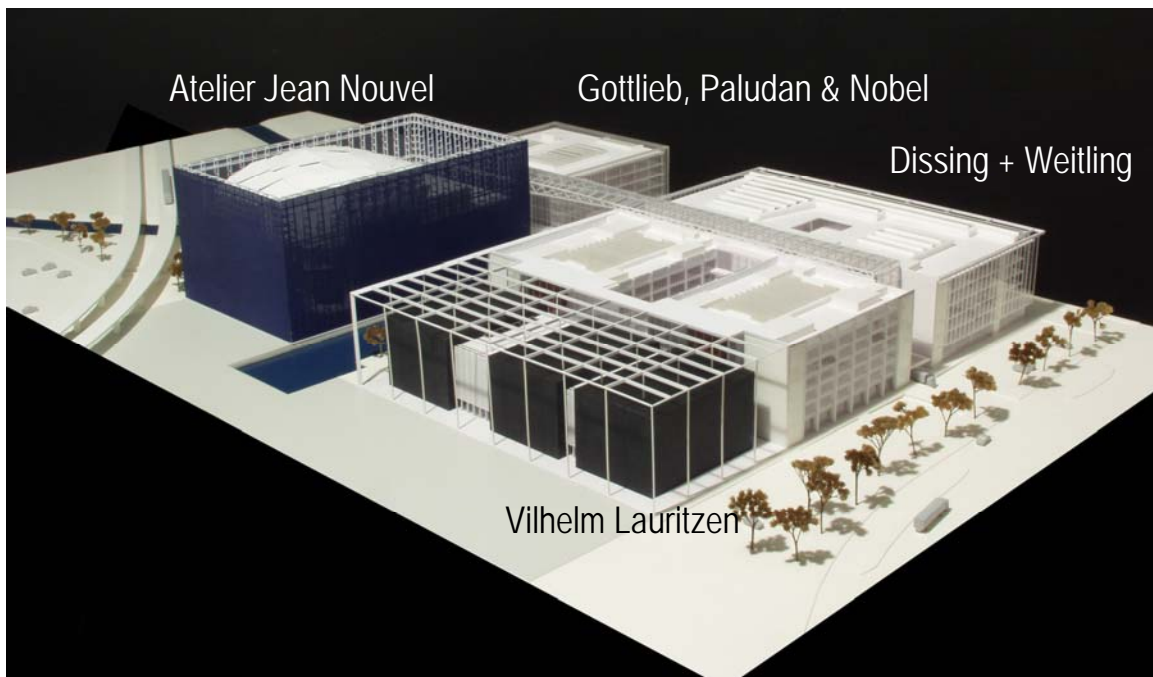
**Figure 2.2.1** Model photo of the winning master plan – seen from south-west

The engineer competition had 6 participants – all Danish, although several with foreign consortium partners. The winner was one of the largest Danish consulting engineering companies, Carl Bro A/S. After these first competitions the design consortium of Vilhelm Lauritzen AS and Carl Bro A/S optimized the master plan as a basis for planning permission from the Copenhagen municipality and started the design of segment 1.

It was decided that the next competition should be on segment 4 with the concert hall as this was seen as a particular complex part with a need for a long construction period. Acoustics is obviously seen as a critical field of competence for this segment. Therefore it was decided to start with a prequalification of a number of internationally esteemed acoustical experts, whom the participating design teams could choose between. The design teams should comprise an architect with an engineer and an acoustic specialist as sub-consultants. In the competition the same acoustic expert could participate in more than one team. The winner of the competition on segment 4 was the French architect firm Ateliers Jean Nouvel with a unique design, where the actual concert hall is raised towards

the top in a meteor-like shape, and the whole segment is covered by a transparent blue screen on all four facades from the ground to the top. In the evening, this is planned to be used as a screen for projection of video/pictures for instance related to concerts in the hall.

The remaining two architectural competitions were won by Danish architects. Segment 2 was won by Dissing + Weitling and segment 3 by Gottlieb, Paludan & Nobel - a joint venture of two smaller firms. The final design of which the four segments in DR Byen is shown in figure 2.2.2.



**Figure 2.2.2** Model photo of the final design – seen from south-east

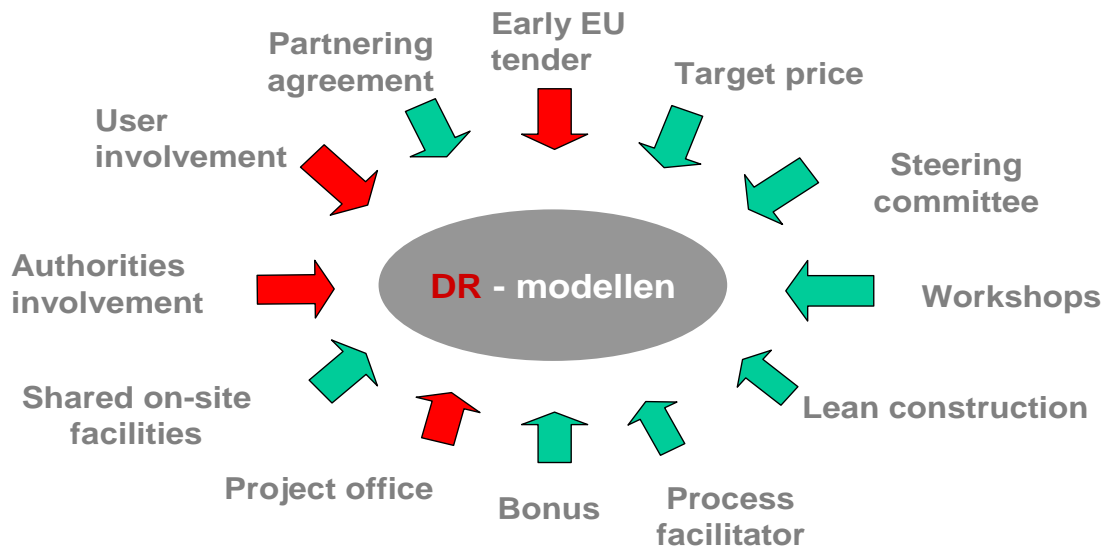
### **The enlarged client organization**

In 2001, the Resource Director left DR, and it was decided not only to find a new Resource Director, but also to supplement this position with an executive project director with the day-to-day responsibility for the building project and reference to the new Resource director. The appointed executive project director wanted to change the client organization from a small internal unit with a strong external PM from a consulting company to a strong internal client organization. The contract with the consulting company was renegotiated and most of the consultants continued to work on the project as part of DR's client organization.

The former project director and deputy project director continued with the responsibility for briefing and conceptual design, while a new project director was appointed with the responsibility for detailed design and construction. The planning of the broadcasting

technology had until then been undertaken by DR's internal technology department, but it was decided that the technology project for DR Byen should be part of the enlarged client organization under a separate project director. The organization was supported by staff functions for administration and communication placed directly under the executive project director.

For the construction stage it was decided to implement an ambitious partnering model. It was based on tendering at the conceptual design stage to get the contractors involved in the detailed design together with the design teams, and a lot of elements were used to improve the collaboration between all the stakeholders. An overview of the elements in the partnering model is shown in figure 2.2.3.

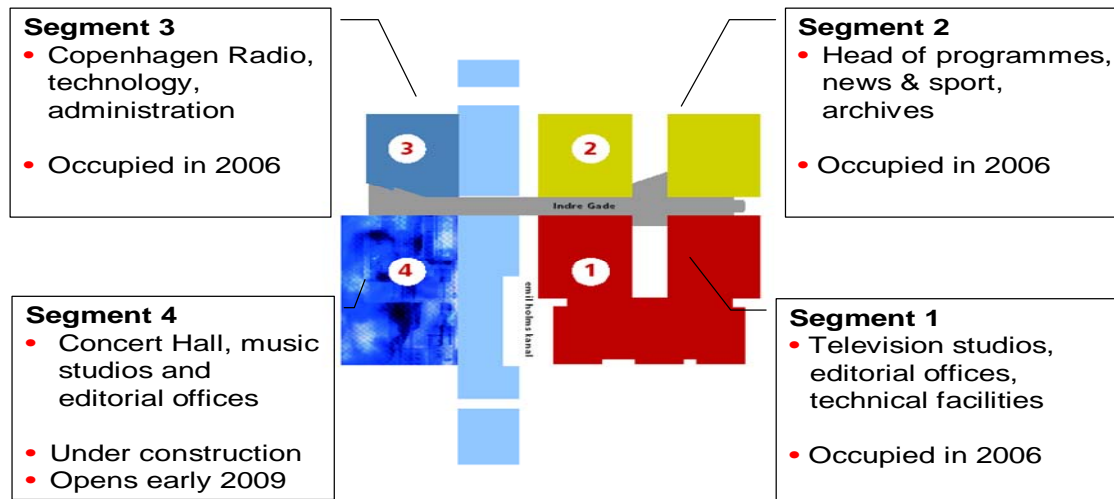


**Figure 2.2.3** The DR Model for Partnering

### **Schedule and budget**

Segment 1, 2 and 3 were finished almost on schedule and occupied during 2006. However, segment 4 has a severe delay and although the offices in the segment have been occupied during the summer 2007, the actual concert hall will not open until early 2009. Figure 2.2.4 shows the main functions in the different segments together with a status for occupation.

The original budget for the building project was €400 million, but due to increased cost, mainly due to problems with segment 4, the final cost is expected to be more than €600 million in price level 1999.



**Figure 2.2.4** Main functions in the four segments and status for occupation

## 2.3 Briefing and User Participation

In recent years the interest in briefing has increased. One reason is that the view of buildings has changed from seeing buildings as mainly architectural expressions or passive physical constructions to regard buildings as facilities that must support the needs of an organization. An increased awareness of buildings as physical frames for work processes, that can either obstruct or be designed to support the dynamic needs of organizations, has emerged. This has been reinforced by the increasing amount of knowledge work and the need for modern organizations to support the creativity of the knowledge workers by a diversity of settings and the need to create suitable working environments to attract the most desirable part of the workforce. Another reason for an increased interest in briefing is the trend for companies to put more emphasis on branding and the possibility of using a building as part of their face to the public. This has all together created a new perspective on briefing as a mean to create supportive surroundings for businesses in new buildings used as symbolic expressions of a company's image.

This section attempts from literature studies to identify how the briefing process can be organized to fulfil these new requirements. This requires a change in the briefing process from an expert based information collection to a guided learning process with involvement of top management as well as end users. It also implies a change from mainly being a process of developing a design or construction brief to a more continuous process during the whole building project from feasibility study to commissioning. An example of this new briefing process is provided from a case study DR Byen.

### Theory on the briefing processes

The new way to regard briefing was outlined by Nutt [1993] in an article entitled "The Strategic Brief". He described the traditional briefing as design briefing defined as a definite phase leading to a set of requirements specified in a design brief to form the basis for a demand-led design process. The nature and pace of change has, according to Nutt, chal-



lenged the simple basis of the traditional brief and exposed the limitations in the logic of its process. The future needs cannot be forecasted with confidence. Instead, Nutt suggests firstly to incorporate truly strategic characteristics in the design briefing procedure, and secondly to foster strategic attitudes within a post-occupancy briefing process. This resulted in a proposal from Nutt of a briefing process starting with an organizational/development brief, a design/construction brief and a use/facilities management brief, which together constitutes the strategic brief.

Barrett & Stanley [1999] has undertaken a major empirical investigation of briefing in the UK, and they observe that briefing is done in a lot of different ways dependent on the experience of the individual professional. There is no formal education of professionals in briefing, and there are no general accepted methods and procedures. They stress that briefing must be seen as a process and not an event, and conclude, that better briefing requires that the building client becomes empowered.

The idea of strategic briefing has been further developed by Blyth & Worthington [2001], but unlike Nutt they do not see the strategic briefing as an overall framework for briefing, but as a specific briefing activity at an initial pre-project stage. In their interpretation the strategic brief is more or less similar to the organization/development brief described by Nutt. Furthermore, Blyth & Worthington operates with a lot of different briefing activities, for instance related to concept brief, project brief, detailed brief, fit-out brief, furniture brief, operational brief, environmental brief and facilities management brief. The brief activities vary according to the organization of the building project.

In Sweden comprehensive research on briefing has taken place, and Fristedt & Ryd [2004] also stress the importance of seeing briefing as a continuing process. They adopt the idea of strategic briefing as an activity in the pre-project phase, but they compliment the strategic brief by a tactical brief in the design phase and an operative brief for the construction phase. Furthermore, they emphasize the continuous follow-up of and feedback between the different levels of briefing activities.

### **Theory on user participation**

The participation of users in briefing is important for several reasons. Among the most important reasons are:

- To ensure that new facilities are designed in accordance with the needs and intentions of the organization
- To learn from good and bad experiences with existing facilities
- To ensure acceptance and appreciation of the new facilities among managers and staff

An important question is whether genuine participation requires real influence on decisions about the building project. This has been investigated in relation to a Norwegian hospital project in Trondheim [Jensø, 1999]. The conclusion was that genuine participation requires some degree of involvement in decision making. However, even with out involvement in the decision making users can obtain real influence on a project by being part of the information process.



User participation is not a new phenomenon. It started in the 1960-ties as part of the increased focus on democracy in the workplace. The development in user participation during the last 30 years has been described by the Swedish researcher Granath [2001] as a change from a power based to a knowledge-based process, and the viewpoint has changed from an orientation on subject areas towards a process orientation.

Granath identified three steps in the development of user participation. The first step had a focus on democratic representation as a parallel to the political system with elected staff representatives participating on behalf of their colleagues in committees with management as a counter part. In the briefing process this meant that staff representatives became members of building committees. The second step had a focus on product quality and was based on the recognition of the need for experts to collect information from users to create sound products and solutions. In the briefing process this meant that interviews with staff carried out by building specialist became commonplace. The third step is based on staff in the knowledge society being the most important resource for companies, and an active involvement of staff is a necessity to create improvements in the work processes.

User participation is of particular importance when a building project is part of an organizational change process. Another Norwegian research project on the hospital project in Trondheim investigated the relation between the development of processes in an organization and the building process. Klagegg et al [1999] define a so-called “clutch effect” (koblingseffekt) between these processes. One of the most important elements in creating such a clutch effect it to define an overall vision for the building project based on the development needs of the organization. The strategic briefing is very much aiming at this. Among other elements in creating the clutch effect is involvement of the users in the building project and creation of a shared understanding of the project among all participations. Use of communication technologies for visualization of the building project are important means in the participative process.

User is a broad term, and it can be useful to distinguish between different groups of users. Both Barrett & Stanley [1999] and Blyth & Worthington [2001] describe a so-called user gap referring to users often not being involved in the dialogue with neither top management nor experts in building planning, because the main dialogue takes place between experts and top managers. However, top managers can also be regarded as a group of users. In the “democratic” step in the development of user participation the main users were top managers and elected staff/union representatives. Another main category of users is the end users, which covers the ordinary employees but can also include middle managers. A special group of users are internal specialists, who get involved in the building project because of there special competencies within a specific part of building planning.

### **Case study**

DR Byen is a complex building project which includes a big investment (€100 million) in electronic media technology. The technology project has been planned parallel with the construction project and integrated in the building client organization. The implementation of the new technology is carried out by the end of the construction work in each

segment, and staff is not moved into a segment before the technology implementation process is finished. Although most of the technology is new, there is also a considerable amount of technical equipment that is reused from existing facilities and moved to the new facilities.

All together 10 briefing activities have been undertaken as part of the DR Byen project as shown in table 2.3.1 together with information on the users mainly involved in each activity and the project stage, where the briefing activities has taken place.

No.	Briefing activity	Users involved	Project stage
1.	Briefing for decision proposal	Top managers	Pre-project feasibility study
2.	Strategic briefing	Top managers and Union representatives	Project definition after board decision
3.	Competition briefing for the master plan	Top managers and selected middle managers	Preparation of competition with follow-up after competition
4.	Construction briefing	Middle managers and staff (end users)	Preparation of competitions with follow-up during design
5.	Technology briefing	Middle managers, technology specialists and staff	Design development and detailed design
6.	Facilities Management briefing	FM managers, specialists and staff	Design development, detailed design and construction
7.	Interior room layout briefing	Middle managers and staff (end users)	Design development and detailed design
8.	Interior furniture layout briefing	Middle managers and staff (end users)	Construction and technology Implementation
9.	Technology removal	Middle managers and staff (end users)	Construction and technology Implementation
10.	Furniture and archives removal	Middle managers and staff (end users)	Construction and technology Implementation

**Table 2.3.1** Briefing activities and users involved in relation to project stages in DR Byen

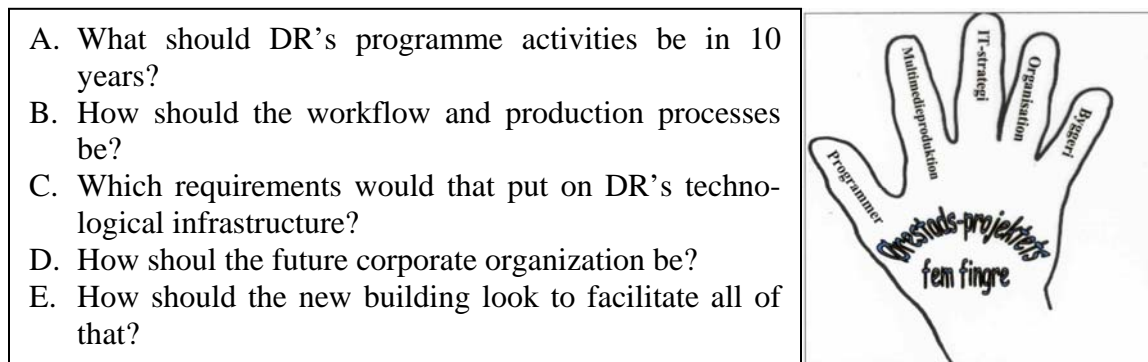
#### *Briefing for decision proposal*

This activity was undertaken during spring 1999 by DR's property management unit with assistance from an external client consultant. It was part of the process of producing a decision document for DR's board on the expected size, quality, cost, schedule and risks in establishing a new headquarters for a relocation of DR's functions in the Copenhagen area. The briefing was based on information on space in DR's existing facilities and estimates on the changing need for space in new, tailor-suede facilities. It was expected that up-to-date facilities could be designed with a 10% reduction of space due to more efficient space utilization (improved gross/net factor etc.) and a similar 10% reduction due to the introduction of new ways of working with open space work environments in the new facilities. The involvement of users in the process was restricted to top managers in DR. The first version of the decision proposal included a concert hall with 1.200 seats and a quality level similar to a recent concert hall built in Denmark, but DR's board had higher ambitions and wanted a concert hall with 1.600 seats and a quality level among the best

in Europe. A revised proposal based on these requirements was approved by DR's board on 1. June 1999 with a budget of DKK 3,0 billion (€400 million), exclusive of technology investments.

### *Strategic briefing*

The strategic briefing was the most important activity in relation to influencing the building project by DR's top management. After the decision on the building project DR's directors launched a so-called Five Finger Plan. The purpose was to define the basic pre-conditions for planning the building project and it was organized as a strategic corporate development program divided into five projects, see figure 2.3.1. Project A - the thumb - concerned which products (radio- and television programs etc.) DR should produce in the future. Project B concerned how DR's program production should be organized. Project C concerned which technology infrastructure DR should be based on. Project D concerned DR's future company organization, while project E – the little finger - was the strategic briefing of the building project. The over all idea with the Five Finger Plan was, that the projects on DR's future products, program production, technology infrastructure and organization should provide information on the basic requirements for the building project. The Five Finger Plan was carried out with DR's 5 directors each managing one project and after half a year the results were finished with a number of reports.



**Figure 2.3.1** The Five Finger Plan

In relation to building planning the result of the Five Finger Plan was a strategic brief which defined the overall visions and intentions for the building and the specific objectives and conditions for the building project. The work with the strategic briefing had included workshops, study tours to new buildings in England and Holland, and seminars with DR's management, internal union representatives and the client organization. A central part of the strategic brief is a scenario with DR's thoughts about how it should be to visit and work in the finished building.

Besides these inputs from the other projects, the strategic briefing included a number of activities specifically related to the building project. One of these was a workshop with DR's directors, other selected managers, union representatives and the client organiza-

tion, where the over all vision for the building project was discussed. The client organization was established over the summer in 1999 with an internal organization headed by staff from the property management unit and supported by an external client consultant headed by COWI, a large Danish consulting engineering company supplemented by PLH architects from Denmark and for the strategic briefing also by the English architects and planners DEGW headed by John Worthington.

The strategic briefing also included a number of seminars as well as study tours to England and Holland to get inspiration from other recent media- and office buildings. The resulting strategic brief from early 2000 had a summary in the form of a scenario description of how it would be to visit and work in the new headquarters. This scenario was used in the competition brief for the master plan, and similar scenarios were made for the following competition briefs.

#### *Competition briefing for the master plan*

This activity mainly included the preparation of a general space budget with descriptions of the main functions and their interrelations. This was partly based on the projects from the Five Finger Plan, which gave provisional information on the number of different production facilities and the expected types and sizes of organizational units for DR's program production. For DR's support functions information was collected from directors and selected middle managers. The more general parts of the competition brief for the master plan were very much based on the strategic brief. The master plan competition and the resulting master plan is described in section 2.2.

#### *Construction briefing*

For segment 1 construction briefing started after the winning master plan was decided as information on this was needed to decide definitely on the distribution of DR's different functions in each segment. The briefing activities took place while the client organization worked together with the design team on optimization of the master plan in relation to DR's and the competition jury's comments to the winning project. The optimized master plan formed the basis for negotiations with the town planning authorities on a specific local plan for the development. For the other segments the construction briefing started during design development of segment 1, and for those segments competition briefing and construction briefing was an integrated process.

The construction briefing was organized in a number of working groups with end users. Each group dealt with a specific functional area in a segment and there were all together 20 of those groups for all four segments. Besides there was one group dealing with shared space in all four segments. Each group had a chairman, who was a manager appointed by DR's directors, and there was up till 10 members in each group. Members were chosen mainly based on their knowledge and competencies in relation to the specific function. One member should be a health and safety staff representative. The client organization decided when the groups should be established and facilitated the work in the groups. A building coordination committee with management representatives decided on the mandates for each group based on proposals from the client organization, and this committee

also reviewed the results of the groups, made decisions on principles and approved the final construction briefs.

The activities in the groups were divided in three steps. The first step included preparation of descriptions of the functions, the relations between functions and verification and distribution of the space budget for the functions. This was the most crucial part of the work as the groups had to evaluate their production processes and plan for changes in relation to technology and organization before moving to DR Byen. The second step was a more technical oriented briefing activity with making detailed descriptions of functions and defining detailed technical requirements for each type of room, which were documented in room sheets. The client organization provided experts guidance in relation to structural, acoustic and electrical aspects as well as HVAC etc. The third step was evaluation of the winning competition projects and documents from the design teams during design development. After each stage of design the work groups commented on the project documents before client approval. In some cases, where contradictory requirements and great complexity made the design process particular difficult, design workshops with participation of end users, designers and client representatives were arranged.

#### *Technology briefing*

The briefing activities in relation to technology were organized similarly to the construction briefing with a number of working groups with participation of end users but there was more participation of internal specialists in relation to the different technologies. The working groups were organized partly in relation to different types of products, for instance sound editing equipment and television cameras, and partly in relation to different systems, for instance master control and communication infrastructure. The results of the briefing were reviewed by a number of business focus groups with top and middle managers responsible for specific business processes before they were presented for approval in the building coordination committee.

#### *Facilities Management briefing*

The briefing activities in relation to facilities management (FM) were undertaken by a general FM working group with a sub-group on building management system (BMS) and two groups on coordination of security and waste handling respectively. The groups had participation of end users but like the technology briefing groups they had strong participation of internal specialist and the client organization had expert consultations involved. The general FM-group had a variety of tasks in relation to planning the operation of the building. These included reviewing project documents in relation to operation and maintenance, evaluation of life cycle cost calculations from design teams, setting up an operational budget, coordination of accessibility for servicing the buildings (lifts, gondolas etc.), defining requirements for digital documentation for operation from designers and contractors, planning of commissioning etc. The sub-group for BMS and the group for security both produced input to a brief for an advanced BMS-system with integration of intelligent building installations, security systems and energy management system. The group for waste handling reviewed the project documents in relation to internal logistics and defined requirements for the waste handling system as part of environmental management.

### *Interior design briefing (room layout and furniture layout)*

The briefing for interior design was like the construction briefing divided in working groups. The main difference was that the groups were smaller with up to 6 members but with more groups as each group was responsible for a more definite functional area as the new organization had been implemented, when this briefing process started. The work was divided in to parts due to the principle of last responsible moment. In the competition and construction briefs it was stated, that the open space areas for office workplace should be flexible in relation to placing small meeting rooms, printer rooms, monk cells etc. The first part of the interior design briefing aimed at deciding, how many of such rooms were needed in each part of the building and where they should be placed. This was timed to give input to the detailed design process, so that these rooms could be implemented in the design and included in the ordinary construction process.

Before this process started a special policy group had decided on the main principles and produced guidelines for the interior design. This included a DVD with inspirations from other companies and an interior design manual with “building blocks” to plan with. On the most difficult problems for the policy group was to reach a decision on principles for reuse of existing or buying new furniture. The group managed to convince DR’s directors that the best solution was to buy new furniture for all ordinary workplaces. This made the second part of the interior briefing process much easier as this concerned the layout of furniture. Both parts of the interior briefing process was undertaken by the same working groups with end users and with guidance from interior design specialists from the client organization.

### *Removal briefing*

The activities in relation to briefing for removal include specific decisions on what should be reused and planning of the removal schedule. This process has been divided according to reuse of technology, which is closely related to planning of the implementation of technology and reuse of furniture and removing archives and storages etc., which is closely related to the interior layout planning, including procurement and delivery of new furniture.

### **Evaluation and discussion**

The case study is an example of a briefing process with a client organization as a mediator between the users on the demand side and the design companies on the supply side. The client organization has facilitated the briefing process and formulated the final brief documents based on input from the users and formulated the requirements and intentions in a form, which is in accordance with the professional language and standard that are common to the design companies. However, the client organization has been careful to make sure, that the users take responsibility for and ownership to the requirements. This was accentuated by the working groups involved in the briefing process having a manager appointed by DR’s directors as chairman.

The briefing process has in general taking place as a more or less continued process following the principles outlined by Blyth & Worthington [2001]. One difference was, that

the strategic briefing took place at the initial project stage after the formal decision by DR's board had been made and not in the pre-project stage as suggested by Blyth & Worthington. The reason for this is that DR is a political controlled institution, where formal decision is necessary at an early stage.

The case is also a clear example of a building project, which is used as part of a fundamental change process in a company. Such a case puts particular emphasis on the timing and coordination of the change processes in the company and the briefing process. This can be compared with the linkage between business planning and facilities planning, which Barrett & Baldry [2003] describes as four alternatives: Administrative linkage, one-way linkage, two-way linkage and integrative linkage. In relation to DR Byen the strategic briefing as part of the Five Finger Plan was an ideal example of an integrative linkage with a fully synchronized coordination between strategic business planning and the strategic briefing for the building project.

Later on during interior design the situation was less ideal as the implementation of the change processes in major parts of the user organization had not progressed sufficiently for the users to be ready for the briefing process, when this was needed to accommodate the building process. The interior design process so to say got caught in the middle between the synchronization of the business processes and the building project. The linkage was no longer integrative but an example of a two-way linkage without sufficient synchronization. This is probably a common situation in huge building project with many years duration. The business organization is changing dynamically and the users want to postpone the decisions on requirements for the interior design to the last possible moment, while the design team wants to know these requirements as early as possible. Therefore, the opinion on the right time for the last responsible moment will vary between the parties – particularly on complex building projects.

## **Conclusion**

With the increased focus on buildings being an important asset for the development of companies and creation of attractive working environment for knowledge workers the briefing process has got more focus and the need to involve the users in the briefing process has increased. Briefing has changed from being a single process in a specific initial stage resulting in a final document with definite requirements to be a continues and interactive process during the whole building project, where the users' requirements and intentions for the different parts of the building process are presented and discussed with the design and construction team, and where the design, construction and commissioning proposals are evaluated and optimized. The client organization has a crucial role in mediating between users on one side and design and construction team on the other side and create synchronized coordination and integration of the business processes and the building process.

### **3. DESIGN ASPECTS**

This chapter on design aspects includes 3 sections.

Section 3.1 on accessibility is based on a paper with the title “Designing for disability – A Danish case study on DR Byen” was presented and published in proceedings from an international symposium on Architectural Management at DTU in November 2005 (Jensen, 2005b). The text presented here has been adjusted.

Section 3.2 on environmental sustainability and section 3.3 on workspaces are both based on case studies from a research report on FM Best Practice written in Danish (Jensen et al, 2007). The texts presented here have been translated and adjusted.

#### **3.1 Accessibility**

The concept of accessibility has over the last decade become increasingly important in relation to disability and the built environment. The concept has changed the focus from dealing mainly with physical access for wheelchair users towards enabling people, including persons with disability, to participate in the social and economic activities for which the built environment is intended. Accessibility is a basic feature of the built environment concerning the way in which houses, public buildings, places of work etc. can be reached and used.

This section presents a case study of DR Byen, where comprehensive requirements for accessibility was integrated in the design process by involving a specialist architect experienced with accessibility aspects as a client consultant. An evaluation of this process is made together with conclusions in relation to the need for increased awareness among both clients and designers, as well as specialist competencies among designers.

##### **Codes, standards and guidelines**

The Danish building codes from 1995 (Boligministeriet, 1995) introduced for the first time in Denmark accessibility as an essential consideration in building planning. Earlier safety and health were the main consideration in the planning of building layout according to the building codes. The building codes from 1977 had, as a first step, introduced requirements for direct level access.

The development of increasing the focus on accessibility was international brought forward by the United Nations, who in 1993 agreed on Standard Rules on the Equalization of Opportunities for Persons with Disabilities (United Nations, 1994). A few years earlier the American government had passed ADA - The Americans with Disabilities Act (U.S. Department of Labor, 1991). The United Nations’ Standard Rules have been officially adopted by, among others, all member states of the European Union. However, it is the general impression that there is a long way to go before the Standard Rules are fully implemented in most countries. This is at least the case in Denmark, although an increased political awareness is recognized.



The current building codes from 1995 contain a number of specific requirements in relation to accessibility, but also several requirements of intentional character. The Danish Standard organization issued a handbook (not a formally agreed standard) on accessibility with guidelines in 1995, but this only focused on outdoor areas, which was later supplemented by a collection of examples on design of recreational areas (Dansk Standard, 1995 and 1999). To supplement the building codes a number of Danish handicap organizations issued guidelines in 1996 on implementing the requirements in the building codes (Center for Ligebehandling af Handicappede, 1996).

More recently an official Danish Standard on accessibility was issued in 2001 (Dansk Standard, 2001). It is a comprehensive document with detailed requirements on all aspects of accessibility in relation to disability and the built environment. The Danish handicap organizations want the standard to become compulsory as part of the building codes, but the Danish government has decided that it should be voluntary for building clients to implement the rules. Thus the standard has the status of a guideline with recommendations. A number of guidelines on specific types of buildings have been published in recent years in Denmark, for instance for housing, museums, sports facilities and for special groups of people, for instance giving guidance to building clients and recommendations on accessibility for the blind and the elderly (Boplan, 2003).

There seems to be a lack of international standards on accessibility. There are a number ISO- and EN- standards on technical aids for handicapped, for instance walking aids, wheelchairs and beds. There are also national standards on accessibility and the built environment in various countries, but no comprehensive international standards on accessibility has yet been adopted. The only European standards concern accessibility to lifts in relation to safety rules for the construction and installation of lifts (Dansk Standard, 2003) and tactile identifiers (ETSI, 1998).

A general introduction to Danish disability policy written in English was issued in 2002. (Danish Disability Council, 2002). The Danish government issued a new action plan in relation to disability in February 2003 (Regeringen, 2003). Among the most important initiatives in relation to accessibility and the built environment was a test project with training consultants in accessibility, introducing an accessibility label for tourism facilities – recently broadened to all buildings with public access – together with a web portal (see <http://www.godadgang.dk> for further information in Danish and English) and changing the law and codes on building to cover some rebuilding project that must comply with certain accessibility requirements.

These actions have all been implemented. The amendments to the building law and codes came into force on 1. January 2005. They cover buildings with public access and buildings for service and administration. Rebuilding projects should implement direct level access, parking and toilets for disabled – and lifts only for buildings with public access - if the cost hereof does not exceed a certain percentage of the total rebuilding project cost.

### **Requirements on accessibility in DR Byen**

In the first versions of the construction brief, from 2001, the requirements in relation to accessibility only referred to the building codes except for the external areas, where the earlier mentioned guidelines (Dansk Standard, 1995 and 1999) were made compulsory. These versions were used as a basis for the design of segment 1. Later on the comprehensive Danish standard from 2001 (Dansk Standard, 2001) were included in the construction brief and has been a basis for the design of the other segments, the internal street and the landscaping.

The text in the latest version of DR's general construction brief is as follows (in a non-authoritative English translation, including titles of the Danish publications; see references for original titles):

*"It shall be possible for disabled people, even without help, to enter and leave the buildings by normal access routes, terraces and personnel entrances and to move around the areas surrounding the complex. It shall also be possible for disabled persons to move around and orient themselves in the buildings without special measures. Refer also to "Danish Building Regulations 1995 – About access requirements" (Center for Ligebehandling af Handicappede, 1996) and "Accessibility for all" (Dansk Standard, 2001) which applies to the whole building.*

*Recreational areas should be laid out such that disabled persons can access and use these areas. Outdoor areas shall be laid out in accordance with Danish Standard's "Outdoor areas for all - planning and design guidelines for providing access for disabled persons" (Dansk Standard, 1995), "Recreational areas for all – collection of examples" (Dansk Standard, 1999) and "Accessibility for all" (Dansk Standard, 2001)."*

The responsibility to fulfil the requirements in the construction brief was designated to the architects of each segment in their contracts with DR.

### **The implementation process**

DR's focus on accessibility was increased in spring 2003 following a letter from the chairman of DSI (De Samvirkende Invalideorganisationer – an umbrella organization for 31 different organizations in relation to disability in Denmark) to the chairman of DR's board. DSI had been contacted by one of the architects on DR BYEN, who wanted advice on disability considerations in the design. DSI informed DR in the letter that they did not have the necessary competencies to act as a consultant and recommended DR to involve a specialist handicap consultant in relation to the design of DR BYEN. Particularly, as the division of the project between different design teams causes a need for coordination between the different segments.

To clarify the situation DR arranged a meeting in June 2003 with representatives from DSI, handicap specialists, the architect teams and the client organization on DR BYEN. At the meeting DR outlined the requirements on accessibility in the construction brief, and the architects teams explained how they were working to comply with these requirements. The meeting revealed some problems in the design, for instance doors to handicap toilets opening inadequately, but the general conclusion was that DR was taking consid-

erations for accessibility serious and had come a long way to implement the requirements in the Danish standard.

However, the need for involving a specialist consultant to coordinate the accessibility aspects on the different segments was not clarified at the meeting. DR's viewpoint was that the responsibility for the design should stay with the design teams. Following the meeting DR questioned each of the design teams, how they would make sure that their design complies with the requirements and what were their competencies to do so. The responses were very different. One team immediately reviewed their project on accessibility. Another team would involve a specialist consultant in the design work. Yet another team stated that they had the necessary competencies in their team without documenting it. The last team did not come up with a clear answer except that they would comply with the requirements.

DR decided on this basis that there was a need for involving a specialist consultant on the client side to review the design from the different teams to make sure, that the requirements were fulfilled. In the autumn of 2003 DR therefore contracted Erik Bahn and his architect company. He was one of the specialists participating in the meeting in June 2003 and he has extensive experience with designing for disability as well as good working relationships with Danish handicap organizations.

Immediately afterwards a review was made of the design projects of all the segments, independent of their stage of development. Later on, review of accessibility has been part of the general client review at the end of each stage of the design development, i.e. conceptual design, schematic design and detailed design. During spring 2005 the reviews of the detailed design of the four segments was almost finished, but reviews of the concert hall, the internal street and landscaping is still ongoing.

The reviews have mainly taken place as a check of project drawings from each design team providing written comments, which the design team replies on and the result is checked in the review at the next stage. On certain issues there have been meetings with a design team and the specialist consultant. In special cases the specialist consultant has produced sketches with possible solutions and improvements. The specialist consultant has also provided references to specialized information to the design teams.

### **Focus areas**

Below the main focus areas for the reviews on accessibility are described together with some examples of the most difficult problems in the process.

#### *Parking*

The supply of handicap parking spaces is a requirement in the building permit for the project. The main problem has been to get handicap parking placed near the main entrances. The specialist consultant has provided information of the necessary sizes and number of parking spaces for different types of handicap vehicles. The landscaping project is still under design development.

### *External access*

The external access is particular difficult because the master plan holds an idea of placing the different buildings on a platform raised 30 cm above the surrounding terrain. This has made it necessary to integrate ramps for wheelchairs around the buildings. Direct level access has been made possible to the main entrance by raising the road and walkway locally in front of the entrance. Entrances to the building with the concert hall will also have direct level access.

Another aspect of external access is accommodating for people with reduced vision. The dialogue between the landscaping architects and the specialist consultant is ongoing in this respect.

### *Internal circulation*

The concerns for internal circulation areas have mainly been to make sure that all corridors are 1,50 m wide, which is required in the Danish standard, while the requirements in the building codes are only 1,30 m for escape routes. Besides, the possibility to manoeuvre wheelchairs in other parts of the buildings has been checked.

### *Doors*

The width of doors has also been an issue. Particularly because doors to production facilities for radio and television need to be soundproof, which reduces the effective opening space. This has been a problem in relation to access for wheelchair users.

### *Lifts and stairs*

This has been one of the most difficult areas with considerable dialogue between the specialist consultant and the design teams. In relation to stairs there are specific requirement for the dimensions of steps, distance between steps, contrasting fronts of steps and shape of handrails, but often these requirements are unknown or neglected by the design teams. In relation to lifts there are similarly specific requirements on the dimensions of the car and the placing and design of control panels. Particularly the requirements of the control panels are generally unknown or neglected – even by producers of lifts. The new European standard in relation to lifts (Dansk Standard, 2003) has not yet been generally recognized. The requirements on control panels have also shown to be conflicting with some architects design ideas.

Due to this it has been hard work to get the requirements on stairs and lifts fulfilled. However, the specialist consultant also has an important role in interpreting the requirements and deciding what is needed and what is necessary to fulfil the intentions in the requirements on accessibility. Not all lifts or stairs need to comply with the accessibility requirements for disabled as long as all parts of the building is satisfactorily accessible.

### *Toilets*

Although the requirements for layout of toilets are very specifically described in the Danish standard on accessibility, there has still been a need for a thorough review of the layout in the project design. Besides, the necessary number of toilets for disabled in special

areas, for instance the staff restaurant, has been an issue of debate – also between the client and the specialist consultant.

#### *Seating in concert hall*

An area of strong concern among the representatives from organizations of disabled is the seating possibilities for wheelchair users in the concert hall. This became clear at the meeting in June 2003. The design team had planned areas for wheelchairs in the concert hall, but the representatives of the disabled found it very important, that wheelchair users could be seated next to their not disabled family members or friends. DR decided, that this request should be followed, and the design team plan that ordinary seats can be replaced with wheelchairs in specific rows in the concert hall.

#### *Hearing aid in assembly rooms*

In assembly rooms installation of a building integrated hearing aid system is required. This is usually designed as a loop wire system with one wire circuit around the perimeter of the room in question. However, such a system will create interference with microphones in radio and television studios as well as music facilities. It has therefore been a technical challenge to find systems suitable for DR's building.

The result has been a combination of conventional systems and so-called super-loop systems. These consist of a number of loops each covering a specific part of the room and each loop can be activated according to the actual need. In the concert hall both systems are used while super-loop systems are used in other music facilities and big studios with audience. A large meeting room has a conventional system.

It has been discussed whether building integrated hearing aid should be installed in foyer areas and the staff restaurant. The result is, that such systems are installed in two designated areas of 50 sq. m each in the concert hall foyer to be used for audience seating during foyer concerts. In other cases temporary systems will be put in place as needed.

#### *Glass doors and walls*

In modern buildings glass has become a very popular building material and that creates problems particular for people with reduced vision. Therefore, marking of glass doors and glass walls nearby has to be implemented. The main problem in the review has been to get the design teams aware of this and specify the areas where marking is needed.

#### *Signage*

The signage system in the buildings is being designed by DR BYEN's client organization with involvement of DR's internal design department. The specialist accessibility consultant collaborates with the person responsible for the signage project and has given advice; for instance on size of typography and color contrasts. Use of tactile maps for external overview signage is under consideration.

### **Conclusion**

Accessibility is an essential concept in relation to inclusive design and it has become increasingly important over the last 10 years – both politically and in practical building de-

sign. The requirements for accessibility have at the same time become much more comprehensive and increasingly complex. It has become a challenge for designers to find, understand and implement the huge amount of recommendations and guidelines.

However, there seems in general to be a lack of awareness among designers in relation to the need to take all necessary considerations for accessibility into account. Most architects and engineers have not been educated in this field and the complexity calls for involvement of specialists with specific competencies in relation to accessibility.

It is very important that considerations on accessibility are taken during the concept design development. If the requirements are implemented at an early stage, it becomes much easier to comply with them. The cost of the necessary measures will also be less if they are an integrated part of the building design. Many measures for accessibility for the disabled give general qualities to the building with benefits for all users over the building's lifetime. For instance wider corridors and stairs make transport of furniture and equipment much easier. In contrast, if measures for disabled have to be implemented after the building is finished, it becomes very expensive. The case study shows that the cost of fees for involving a specialist consultant on accessibility is very small, approx. 0,1% of all consulting fees and 0,01% of the total budget.

Besides DR BYEN, a new opera house opened this year and a new theater building is under construction in Copenhagen, both have involved a specialist consultant on accessibility (Rødsgaard, 2005). This follows a public criticism of a recent extension of the Danish National Art Museum, where accessibility has not been considered adequately.

The involvement of a specialist consultant makes sure that the essential knowledge is integrated in the project team to comply with the requirements on accessibility. It also gives the possibility to optimize the design by interpreting the requirements and deciding what is needed and what is necessary to fulfil the intentions in the requirements on accessibility. This requires professional experience, but education of designers in accessibility is a very important starting point to get an appropriate number of specialists. Furthermore, an increased awareness among clients on accessibility is important to make building design companies and individual designers give this due consideration.

### **3.2 Environmental Sustainability**

DR Byen is a unique example of a building in Denmark, where considerations for environmental sustainability has been in focus in the planning of the project right from the start. DR Byen is also an environmental demonstration project, where special efforts are made to document the effects of the environmental aspects and to inform widely about the environmental work. This is part of the conditions for the financial support that the building project has received from EU as a so-called IT-ECO project. DR Byen will be the first Danish building project with groundwater cooling and the building will have the largest building integrated solar panel installation so far in Denmark.

However, the effort to implement environmental considerations fully in the building design has been equally important as these environmental technology installations. In principle every choice of material and technical solution in the building design has been evaluated from an environmental perspective as an equal factor to functionality, esthetics and cost. A pleasant indoor climate, and next to that low energy consumption, has had the highest environmental priority in the design. Work environment has also been a high priority. However, health and safety conditions during construction are not dealt with in this case. Even before the building is finished DR Byen has received several environmental prizes.

### **The basis for the environmental work**

DR formulated an environmental policy for the project in the introductory phase and this included the six points shown in the text box above.

#### **DR's environmental policy for DR Byen**

According to DR's environmental policy DR Byen should be:

- A leading edge but not experimental building project in relation to environmental friendly buildings and implementation of ecological aspects
- A fully environmental friendly building with effective ecological elements integration in the development within the budgetary restraints
- A project where all phases are carried out in accordance with the principles for environmental management in ISO 14001 and as specified in "Handbook on Environmental Design", PBS, publication nr. 121
- A building where the consideration for resources, health and environment – in the whole building life cycle – are treated equally to other main requirements, needs and intentions
- A building project where focus is on prevention rather than cure in relation to all environmental aspects

Furthermore, an overall environmental screening was made, leading to the formulation of environmental objectives related to the 10 most important potential environmental effects from the project, see text box below. These objectives were included in the competition brief for the master plan and in the construction briefs each objective was detailed with a number of specific requirements. For instance, in relation to energy one of the requirements was to reduce energy consumption by minimum 33% compared to the Danish building codes from 1995. (New energy requirements have been implemented in the Danish building codes in 2006 with a 25% reduction)

An environmental expert from DR's client consultant was part of the client organization with responsibility for the overall environmental management. Besides, each design team should carry out environmental management on their segment. The client organization has continuously controlled the environmental work on the different segments to secure the implementation and environmental audits as well as thorough checks of the design teams' documentation for the indoor climate have been undertaken.

### **Environmental issues in DR Byen**

"Environment" covers all ecological, environmental and health and safety aspects in relation to the building in its whole life cycle. During the preparation of the master plan for the building a number of environmental issues of importance to comply with DR's environmental policy were identified:

- Energy consumption
- Landscape, nature and recreational areas
- Polluted soil
- Waste
- Use of materials – structures, chemical substances and materials
- Indoor climate and comfort
- Acoustics
- External noise and vibrations
- Work environment
- Water consumption

### **IT-ECO**

From early in the project the client organization worked together with the German environmental specialist company DS Plan, which was a sub-consultant to the Danish client consultancy company COWI. As part of the initial investigation of possible general environmental measures DS Plan produced concept proposals on ground water cooling and reuse of rain water together with calculations of the consequences of the proposals. It was decided to implement both proposals.

Later on DR, COWI and DS Plan worked together on an application to the EU for financial support. The application was aimed at an EU program that supports building integrated ecological measures in IT intensive buildings – thus the name IT-ECO. The application was successful and support was granted towards the ground water cooling, a solar panel system and intelligent double facades. EU did not want to support reuse of rain water, but DR has decided to install the system anyway. The support from EU implies that a comprehensive documentation of the effects of the different measures has to be made and DR Byen will be an environmental demonstration project.

### **Measures and focus areas**

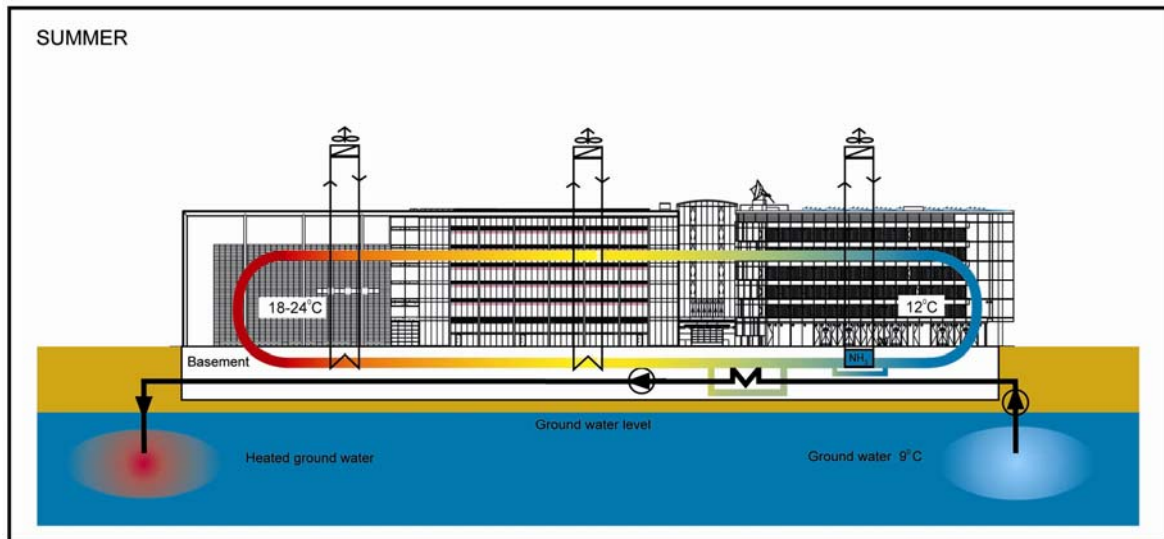
In the following these measures are described in more detail together with some other environmental focus areas.

#### *Ground water cooling*

The system for ground water cooling basically consists of two drillings to the aquifer layers approx. ca. 20 meters below DR Byen. From the "cold" drilling, ground water is pumped up during summer and by an exchanger the cold water is utilized for the cooling system in DR Byen as "free" cooling energy. The ground water with a temperature increase of 2-3° C is pumped down into the ground again via the "hot" drilling so the amount of ground water is in balance. During winter the direction is reversed and the cold



outside air is utilized as free cooling to cool the ground water down to keep a temperature balance on an annual basis. The summer situation is indicated in figure 3.2.1.



**Figure 3.2.1** Concept for cooling – summer situation

The permission to establish the system has required an intensive dialogue with the environmental authorities. It has also been necessary to make agreements with the owners of neighbouring sites as the drillings needed to be placed outside DR's site to get sufficient distance between the two drillings. The maximum cooling capacity of the system is 2,5 MW. A conventional cooling system has been established as back-up in case the ground water cooling system cannot deliver the expected effect. It is the first ground water cooling system in Denmark but similar systems have been established for instance in Germany.

#### *Solar panels*

The system for Building Integrated Photo-Voltaic (BIPV) consists of a number of electricity producing panels with solar cells placed sloping on the roof of segment 1 and 2. In segment 1 the panels are not visible from below, but in segment 2 they are placed above the glass roof covering the news room atrium. The panels are integrated in the roof and also functions as sun shading. There has been put a lot of effort into the design of this roof arrangement to give an architectural satisfactory solution. The total area of the panels is approx. 1.060 m<sup>2</sup> and the expected effect is approx. 100 MWh per year. It is the largest BIPV system in Denmark.

#### *Intelligent double facades*

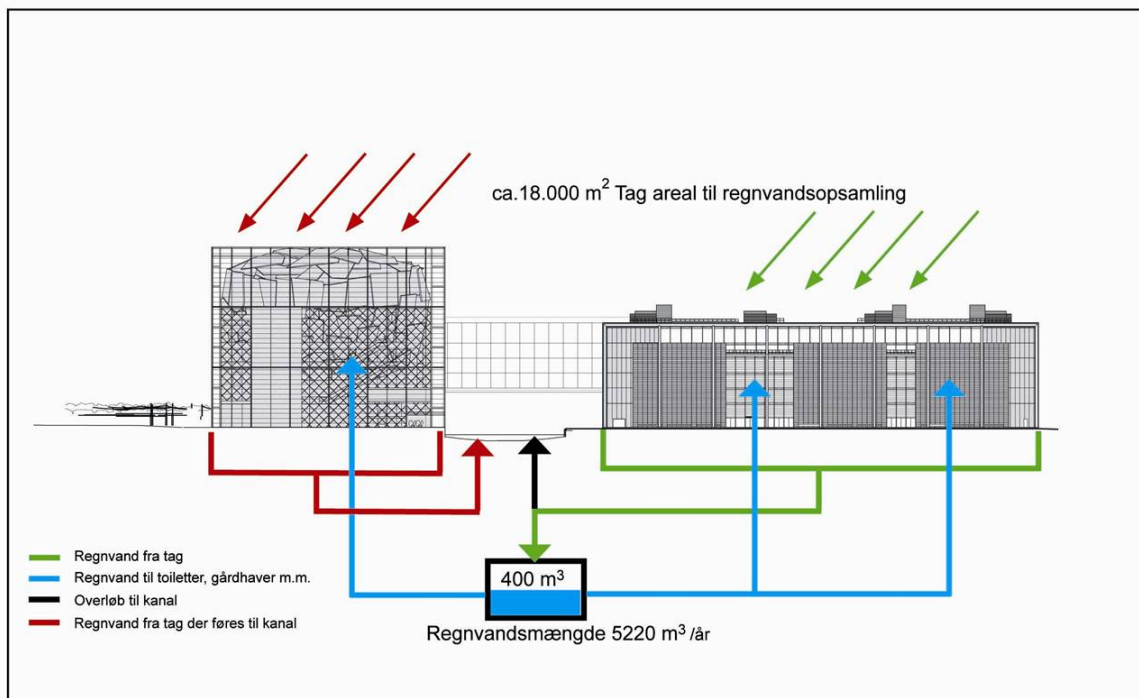
Most of the facades in DR Byen have been designed as double facades and the facades are in many parts of the buildings part of systems for natural ventilation. In most cases the double facades are designed with an inner structure with high insulation thermo glass panels og opening parts, while the outer structure is a single layer of glass with some

openings. This means that the inner structure is active and the outer structure is passive. By opening the parts in the inner structure fresh air can be pulled through the building and let out through openings in the roof above atriums. The opening parts can be controlled automatically by the Building Automation System (BMS).

Due to the support from EU it has been possible to establish opening parts in some of the outer structures of double facades and provide a higher degree of control of the natural ventilation. This creates opportunities to compare the functionality of different designs of double facades and different control strategies. A comprehensive measuring program is included in the IT-ECO project to document the different solutions and make it possible to evaluate them.

### *Rain water system*

The rain water system collects water from the roofs on segment 1 and 2 in a container placed in the basement by segment 1. The collected water is used for toilet flushing, watering plants in courtyards and atriums etc. The rain water from the roofs in segment 3 og 4 is transported to the canal running through DR Byen as it did not prove to be economical to reuse it in the buildings, partly because DR could not get permission to reuse rain water in toilets for the audience in the concert hall. There is also an overflow connection from the water container by segment 1 to the canal. Almost 90% of the estimated water consumption in the buildings will be provided by the collected rain water from the roofs in segment 1 and 2. Figure 3.2.2 below shows the principles of the rain water system.



**Figure 3.2.2** Principles for rain water collection

### *Materials without PVC*

DR decided from the beginning that materials containing PVC should not be used in the construction of DR Byen. It turned out to be necessary to change the absolute ban of PVC to the requirement that PVC should be avoided if possible. The main challenge in relation to PVC in the building project turned out to be the transparent blue screen, which is an important architectural feature as an outside cover of the facades of segment 4. The screen is planned for projecting pictures, when it is dark outside. It was impossible to find an appropriate screen without PVC and DR had to accept the use of a material containing 25% PVC as a coating on a woven, pre-stressed screen of polyester. One reason for the acceptance was, that the producer had developed a process where PVC and polyester can be separated and the raw materials reused in the production of new products.

In a few other cases materials containing PVC have been used in DR Byen in spite of the requirement to avoid PVC if possible; for instance electrical switchboards, cable trays and sewage pipes. The reason has mostly been negligence from contractors or suppliers. In each of these cases it has been decided whether the products should be replaced or had to be accepted based on an overall evaluation.

### *Emissions from building materials and furniture*

Another focus point has been to avoid emissions from building materials and furniture in consideration for the internal climate in the building. DR has specified a series of requirements to avoid hazardous substances and the building materials should if possible have been tested to meet the demands of the Danish Indoor Climate Labeling. During design life cycle screening of a number of materials has been carried out together with other measures. During construction a systematic check has been made for instance of glues, joint materials and paints to ensure that they comply with the specified requirements, including no use of solvents and other hazardous substances.

In the interior planning project the emissions from new furniture has had particular focus. There have been tests of the different furniture parts according to the Danish Indoor Climate Labeling. Based on these tests it has been a requirement to the furniture supplier, that all furniture before delivery should be stored for at least 30 days in a room with specified conditions in relation to size, amount of furniture, humidity and ventilation. It was the first time that a customer made such a requirement and the producer had to fit out a room particularly for this purpose.

### *Waste*

Great efforts have been made to ensure an environmental friendly handling and disposal of waste with a maximum of reuse both during construction and during operation of DR Byen. In relation to operational stage DR established a work group as early as 2001 to participate in the briefing process and in scrutinizing the design documents for the building. One of the results is the implementation of decentralized collection points for waste in dedicated rooms for printing, copying and waste, where each member of DR's staff shall dispose waste sorted in 5 fractions (burnable, paper, cardboard, glass and batteries). Besides that the FM department collects 5 other fractions (toner cartridges, office electronics, fluorescent tubes and low energy light bulbs, oil and chemicals as well as other reusable waste). All the waste mentioned is collected in a centralized waste room in the

basement in segment 3 with access for trucks to remove it. There is a chilled room for kitchen waste as well. Particularly for waste from the large workshops in segment 1 and 2 some containers are placed nearby east of segment 1.

During construction sorting of waste a number of fractions has been arranged by the building site. For instance an amount of 4.6421 tons waste was handled in year 2005 and hereof 75% was disposed for reuse and 16% for burning. The remaining part was disposed for further sorting or depositing.

### **Results and experiences**

At the moment there is no final documentation of the measurable results of the environmental work in DR Byen. These will appear when the operational experiences have been achieved, the documentation from the IT-ECO project has been produced and user satisfaction surveys of the indoor climate etc. have been evaluated. In relation to energy the specified objectives are expected to be fulfilled. In that case there will be a saving of 75% on energy for cooling compared to a conventional cooling system based on compression cooling and a saving of 33% on heating compared to the Danish building codes from 1995. This is equivalent to saving 42% on the emission of CO<sub>2</sub>. The energy index based on utilization of IT intensive offices 40 timer per week is calculated as 54 kWh/m<sup>2</sup> for DR Byen and 20 kWh/m<sup>2</sup> hereof is electricity consumption for basic lighting, mechanical ventilation, cooling and pumps. This is approximately 50% lower than normal for similar office buildings.

An important factor behind the high ambition level of the environmental work in relation to DR Byen has been a clear support from the top management in DR. The chairman of DR's board and the building committee, Finn Aaberg, has from the beginning personally put strong emphasis in a high environmental profile for DR Byen. That this emphasis was present from the beginning has as such been of great importance. It made it possible to clarify the environmental policy and requirements as well as the responsibilities and procedures before making agreements with the design teams. A measure like groundwater cooling has required comprehensive investigations and dialogues with authorities and an early start of this process has been necessary to have enough time to implement it as an integrated part of the building project.

The experiences also show that it is necessary with an ongoing effort to ensure that the environmental requirements are taken into consideration and to make the priorities between environmental considerations and other aspects. From an environmental point it can be relevant to specify rigid requirements but the example on PVC in DR Byen shows that it can be necessary to make compromises and relax the requirements. Therefore, one has to be prepared to reevaluate the environmental requirements during the process and it should be possible to adjust the individual requirements to achieve the optimal solution based on a holistic viewpoint. It is also necessary with ongoing follow-up and check that all involved take the environmental considerations serious and not more or less consciously give them low priority, because it is easier to do what they usually do or cheaper to use a product that does not comply with the environmental requirements.

### **Environmental prizes**

DR Byen has received several environmental prizes as recognition of the environmental work even before the building project is finished. In 2005 DR Byen was awarded the Company Prize, given to companies that lead the way for others, from the Copenhagen Municipality. The same year DR Byen was awarded a Special Environmental Prize for showing new possibilities in environmental friendly building from the five so-called dogma municipalities: Albertslund, Ballerup, Fredericia, Herning and Copenhagen. In 2006 DR Byen was awarded the Solar Prize for a huge, elegant and architectural elaborated solar panel system from the Copenhagen Municipality and the association Solar City Copenhagen.

## **3.3 Workspaces**

From the start it was a management decision in DR that the work spaces in DR Byen should be planned as open plan environments. But what does that mean more precisely, and how does the management get staff acceptance of a radically new way of producing TV and radio?

This is the focus area of this section. The starting point is the preconditions for defining the amount of space to plan with for the new headquarters before the decision on starting the building project was taken back in 1999. In the beginning the planning of the building was a very top management controlled process, but a crisis between management and staff changed the process to be characterized by an extensive involvement of staff both in the briefing of the building as well as in the interior layout and move planning. In the case the main focus is on the interior layout planning of the open work spaces. At the end of the case some of the main results and experiences from process are described and evaluated in spring 2007 after most of the staff has worked in the building for ½-1 year after the move during 2006.

### **Space preconditions**

DR Byen is a very huge building project, and when segment 4 with the concert hall is finished the total floor space will be over 130.000 m<sup>2</sup>. However, this is less than DR's space in the Copenhagen area before the relocation project started. In 1999 DR had approx. 150.000 m<sup>2</sup> distributed on 12 addresses around Greater Copenhagen with TV-byen (TV town) and Radiohuset (Radio house) as the most important.

Before starting the planning of the building project in the summer of 1999, a decision document was prepared by DR's real estate department and the client consultant Carl Bro A/S. Based on an overview of DR's existing space it was estimated that the spaced requirements in the new development could be reduced by approx. 20%. One half of this space reduction was expected to come from joining all DR's function in the Copenhagen area at the same site in buildings designed according to the needs of DR's way of production in the future. The other half was expected to come from the changes in the interior layout from mainly being small offices to open environments in DR Byen based on the concept: "New ways of working".

With these space reductions and extended space for the concert hall facilities in DR Byen compared with the former concert hall facilities in Radihuset the total space need was estimated as 125.000 m<sup>2</sup>. During the planning process the space has been increased to the final 132.500 m<sup>2</sup>.

After the decision on the building project DR's client organization produced an overall brief for the need of net floor space for different units and functions in DR. As a basis for this, DR's top management had approved a space norm for work spaces in open environment of 10 m<sup>2</sup> for each workstation and additional 3 m<sup>2</sup> for various related functions. During a project revision due to a need for cost reductions after the first architectural competition on the master plan the space norm was reduced by 10%. The resulting space norm is indicated in table 3.3.1.

Function	Net area
Each workstation	9.00 m <sup>2</sup>
Addition for	
- meeting rooms	0.90 m <sup>2</sup>
- printer/copying room	0.45 m <sup>2</sup>
- archives	0.90 m <sup>2</sup>
- café areas	0.45 m <sup>2</sup>
Sum	11.70 m <sup>2</sup>

**Table 3.3.1** Space norm for work places in DR Byen

The 9 m<sup>2</sup> is for one workstation (desk with PC and low shelves etc.) as well as internal circulation space between workstations, small guest and meeting places, and eventual quiet rooms for sharing. The general circulation space in the open environments is not included in the 9 m<sup>2</sup>. In addition to the 9 m<sup>2</sup> there was for each workplace planned with 2.7 m<sup>2</sup> for meeting rooms, local archive rooms, printer rooms and café areas. These facilities were expected to be placed permanently on the floor plates independent on which department was using the floor during a specific period.

Besides the workspace there was in the whole complex included a number of common facilities as staff restaurant, cafés, meeting centre and library etc. as well as a huge number of specialized facilities for TV and radio production, technical functions, workshops, stores, garages etc.

The Five Finger Plan described in section 2.3 was a very top management driven process, and this caused big problems in the collaboration between management and staff in DR. One of the reports from the Five Finger Plan unfortunately included the management's ideas about closing DR's television entertainment department and to move part of DR's production to its provincial centre in Jutland. When this became known it caused an uproar among DR's staff and led to staff meetings in the canteen in TV-byen. The internal

union representatives were put to a side and the so-called "Think-tank", mostly with news journalists well-known from the television screen, was established to be in charge of the situation on behalf of the staff. All formal collaboration between staff and management was immediately put on a hold.

DR's former director general wrote about the situation: "I went much too quickly ahead and made the mistake that the five project groups (one for each finger), which in a hurry had been formed to produce the Five Finger Plan, was established and started over the head of the staff." ... "The results of the work were ready by the end of the autumn of 1999 and they were excellent. But in relation to the staff they were seeds on a stony ground. Unfortunately, they coincided with a new media agreement where DR was forced to privatize a major part of DR's TV production".

After several months the management of DR and the Think-tank reached an agreement about a platform for a renewed collaboration. This involved establishing analysis groups with participation of staff to reevaluate the results of the Five Finger Plan and a number of other issues in relation to DR's internal processes. The analysis groups should be formed by both staff and managers based on a process where individuals expressed their interest in participating in one of the various groups.

### **Analysis Group E**

In relation to the building project the Analysis Group E about the physical layout of the building was formed, and the group got the following two tasks:

- To secure staff and managers influence on the planning of the building project
- To propose components for the layout of the building, particularly in relation to advantages and disadvantages when working in more or less open environments

The first task resulted in a proposal about establishing workgroups with up to 10 participants that should recommend the requirements for the different parts of the building. Members should be chosen among staff and managers with the relevant competences in relation to the scope of the workgroup. Each workgroup should be headed by a chairman appointed by the board of directors and other members appointed by the staff and managers in the appropriate functional area, while the client organization should be in charge of the secretarial function. This proposal was accepted by the main work committee and the board of directors in DR.

The other task was much more difficult. Early in the process it was realized that some of the attitudes to the basic preconditions for the building project was putting a block to a constructive collaboration in the group. The questions about open plan offices versus individual offices and the "right" for individual ownership to workplaces were among the problem areas. When a shared understanding of such issues not being a question of either/or but both/and, a more constructive dialogue evolved. One of the activities that helped to change the understanding was a number of visits to other companies working in open plan environments.

The result of the work in the group was a report from October 2000 with some minimum requirement to the design of open plans in relation to structure, communication and the overall impression of the rooms and to light, sound, ventilation, flexibility, café areas, copying and printing areas, wardrobes og bath facilities, meeting rooms and the location of studios and editing suites etc.

The group had attempted to define different types of staff and related requirements to workplaces and layout, but the conclusion from these exercises was that they tended to be looking backward. Instead the group put focus on recommending methods to understand and analyze the future types of staff. The following basic factors were identified:

- When and how does a person use the workplaces
- Which work tools does the person need for the daily work
- Who does the person collaborate with

It was recommended that the interior planning should take an analysis of the need of the staff in question as a starting point, and also that an interior planner should be appointed to assist each department in the planning process. Even though open plan offices would be the dominating layout, the group also recommended that the different needs of various functions should give the possibility of variations in the combination of open spaces and enclosed offices, and that the local conditions should be decisive for the combinations of individual and shared workstations. Furthermore, the group presented a large number of different principal furniture modules for the interior planning.

### **Building briefing**

Following the recommendations for Analysis Group E the building briefing started during the winter of 2000-01 with a large number of workgroups involving staff and managers representing different functional areas of the building. A total number of 20 such groups with the responsibility to develop the input to the briefs for each of their physical part of the total building were established. Besides, a cross-cutting workgroup was established with the responsibility for input to the briefs on all the common areas in the building – both the areas with public access and the internal common areas.

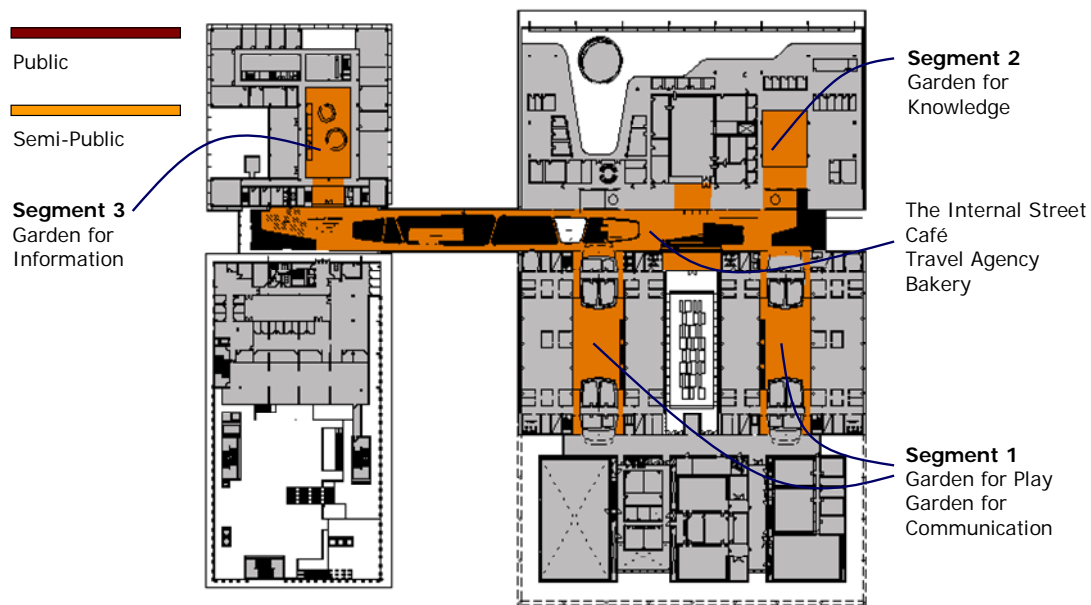
The results of these groups' work formed the basis for segment specific building briefs for each of the 4 segments as well as for The Internal Street (Indre Gade). Furthermore, a general building brief was produced with the overall requirements to the building, including the minimum requirements from Analysis Group E.

In figure 3.3.1 the internal common spaces - The Internal Street and atria – are shown on the second floor of all DR Byen.

### **Interior planning**

Alongside the building briefing the client organization produced a process plan for the interior layout planning. The process plan was accepted by DR's management by the end of 2002.





**Figure 3.3.1** Floor plan with internal common spaces

As part of this plan each of the departments in DR should analyse their internal processes and activities from the perspective of how they should be carried out after the relocation to DR Byen in a fully multi-medial and digital organization. It had been discussed with DR's managers whether such process analyses should be the first part of the interior layout planning facilitated by the client organization or carried out by the departments themselves without the involvement of the client organization. Even though DR's managers wanted to be responsible for the process analyses, it turned out that the departments in several parts of DR were not fully prepared when the interior layout planning started. In these cases the process analyses had to be addressed in the interior layout planning.

In the preparation of the process plan DR's basis organization had focus on the amount of staff resources that the interior layout planning would take. To reduce this, it was decided to limit the size of the workgroups to a maximum of 6 representatives from staff and managers. The original process plan involved approx. 30 workgroups and the resources for representatives from DR's basis organization were estimated to a total of 13 man years. However, it turned out to be necessary to establish considerably more groups – around 50 with a participation of approx 300 staff members, i.e. 10% of all DR's staff.

#### *The policy group*

A central element in the process plan was to establish a Policy Group, which should elaborate on the work of Analysis Group E and produce more specific principles, guidelines and tools for the workgroups. The Policy Group mainly consisted of management representatives, but also the chairman of DR's internal union council, representatives from DR's health and safety unit and the client organization were members. The result of the work in the Policy Group was a handbook for the workgroups, a video with inspira-

tional material and a number of building blocks (furniture modules). The building blocks were included in the handbook with descriptions and drawings, but they were also produced as physical models that could be put on drawings of floor plans to make the interior layout planning as play-full and concrete as possible.

A basic viewpoint in the handbook is that the function and the characteristics of a person's work should be decisive for the kind of workplace one uses rather than the job title. Thus it is a general principle that also managers have their workplaces in the open environments. The former director general Christian Nissen personally stepped forward and had his office area in TV-byen changed to open plan with his own workplace, which made it very difficult for other managers to demand their own office in DR Byen.

Among the guidelines were that the height of furniture as a main rule should not exceed 120 cm. With this height one can work sitting down with some screening and the possibility to overview the local surroundings, while a person standing or moving around can overview the whole floor space and orientate himself and experience the room as light and friendly. With higher furniture the shelves may be regarded as walls, and the noise level can easily become a problem, because one cannot see those who may be disturbed by one's noise, and those being disturbed may have problems identifying the source of the noise.

The building blocks for the workplaces were divided into:

- My workplace, which is usually used by the same person
- Our workplace, which is used by different people in turn; with a subdivision in function based workplaces and special workstations
- Everybody's workplace, which is small workplaces for check of e-mails etc., placed in common spaces or break areas for production staff. In addition, the whole building has wireless network so one can make one's own workplace anywhere with a laptop.

Similarly, there were building blocks for My archive, Our archive og Everybody's archive, Our meeting room and Everybody's meeting room and Our informal meeting space and Everybody's informal meeting space.

This terminology had without any doubt a relation to the discussions in Analyse Group E about the "right" for individual ownership to workplaces etc. At the same time, there is a clear relation to the internal discussions in DR on the profile of TV channels after DR started its second channel DR2. The profile of DR2 was characterized as My channel and should be a channel where groups of viewers could find programmes that suited their special interests. DR1, on the other hand, should be Our channel with a broad appeal to most of the viewers. In that way the terminology in relation to furniture mirrored the terminology of DR's core business.

An important task for the Policy Group was to clarify how much of the existing furniture should be reused in the new building, and how much should be procured as new furniture. The handbook for the interior layout included considerably smaller desks than was

normally used earlier. The reason for this was partly a decision to generally use flat computer screens to reduce heat load and thereby the need for cooling as well as to reduce the need for space. Another reason for smaller desks was to generally improve space utilization. The board of directors in DR had originally decided that most furniture should be reused, and it took a long time to produce a convincing argumentation to get a new decision about having most of the workplace furniture procured as new.

Prior to the presentation of the handbook the board of directors in DR issued a policy statement to all DR's staff and managers, where the main principles for the interior planning were included. The policy statement started by presenting a vision for DR Byen; see text box. The Policy Group and the client organization also arranged a workshop for all managers in DR, where they were introduced to the interior planning process and what was expected from them in that context.

DR's Vision for DR Byen:

**DR Byen – a world class multimedia house**

What does it mean to the *Danes*?

- Better programmes
- More choice

What does it mean to the *users*?

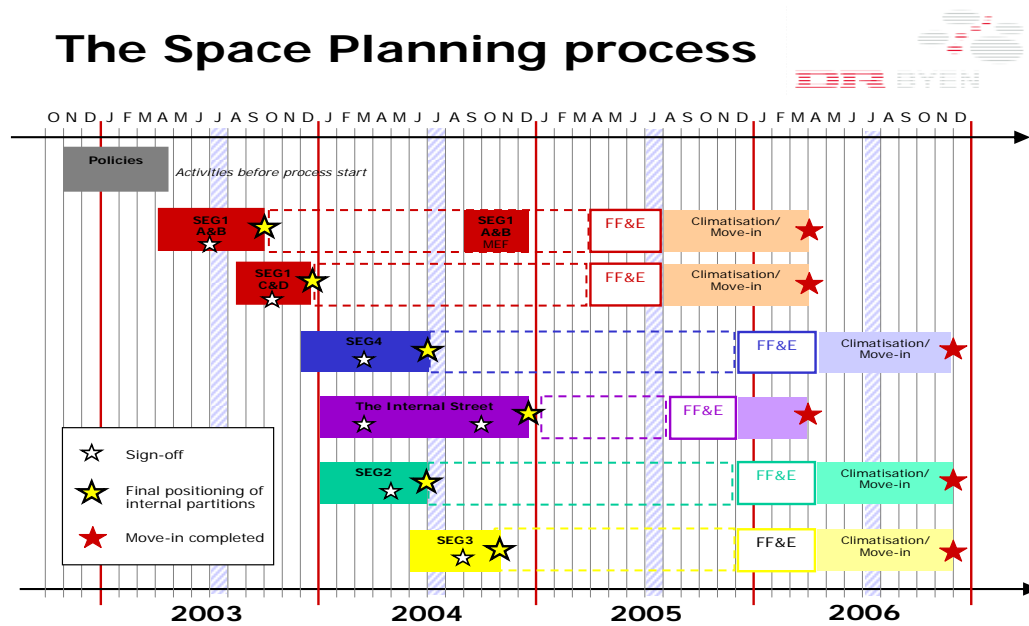
- A flexible and open work environment
- An inspirational base for collaboration and creativity

*Two main stages*

The interior planning was carried out as a very structured process divided in two main stages. The first stage was the principal layout, where all the fixed building components should be placed so this could be implemented in the construction process. The workspace areas in the building were planned as flexible floor plates, where small meeting rooms, project rooms, quiet rooms, archive rooms and copying and printer rooms could be placed anywhere according to need as late as possible in the construction process. During the principal layout planning the exact amount, size and location of such rooms should be decided. The workgroups carried out an interior layout briefing with assistance of interior planners from the client organization, and based on this brief the design teams produced a design proposal for each of the workgroups to accept.

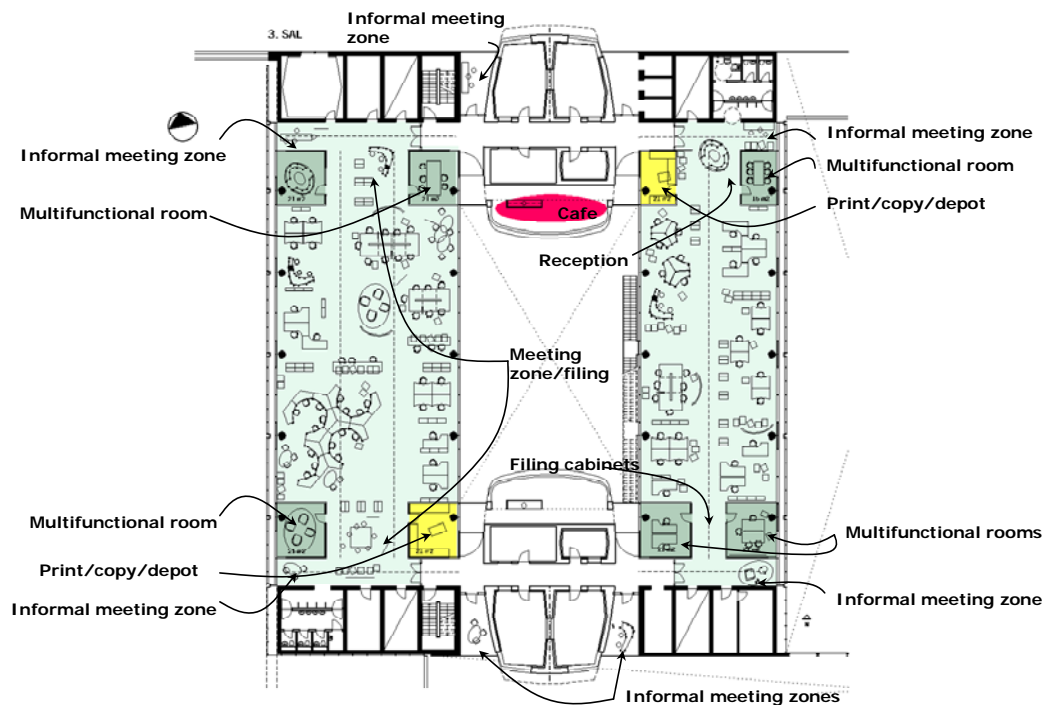
The second stage was the detailed layout where the final furniture layout was planned. This process was on the one side closely related with the procurement of furniture, which was organized with an EU-tender within the frames of procurement agreements of the Danish State, and on the other side with the move project, which was responsible for moving furniture to be reused and archives etc. from DR's former locations.

The overall schedule of the interior design planning is shown in figure 3.3.2.



**Figure 3.3.2** Schedule for the space planning process

An example on the interior layout of one floor in segment 1 is shown in figure 3.3.3.



**Figure 3.3.3** Example of space plan from segment 1.

## **Results and experiences**

Compared with the recommendation from Analysis Group E the workspaces in DR Byen have become very open environments. Individual offices hardly exist except for approx. 50 rooms in music departments in segment 4, where part of the staff has to listen to music as an integral part of their work, and a modest number of quiet rooms and special rooms for editing and subtitling in other segments. There are only a few group offices for 4-6 people planned as project rooms.

All other workplaces are in open environments. This is also the case for a number of workstations for editing video and sound where listening is done with headphones. Even speaking is to some degree done at workstations in open environments by use of close range microphones. However, the size of each floor plate is relatively small, and by placing meeting rooms and other small rooms the floor plates have been divided in smaller parts that can be easily overviewed.

The buildings' very transparent character with glass facades from floor to ceiling almost everywhere provides pleasant daylight in the building. It is also very easy to overview the space, and one can see which colleagues are present. Compared with before, where the same kind of overview did not exist, people are now more likely to go to talk with another person. The downside of the transparency and the overview is a lack of meeting rooms with the possibility of privacy, which provides problems for instance in case of serious talks between a manager and a member of staff.

Besides, the building is characterized by a considerable amount of common spaces. This includes atriums in all segments and de-central cafés, and the experience is that these are used more or less as intended. The staff meets colleagues from other departments more than before. The Internal Street is not yet fully in use and the same goes for the public accessible spaces. Therefore, the use of the whole complex can not be evaluated at the moment.

The involvement of staff in workgroups during briefing and interior planning has given them a considerable influence on the design of their new work environment. There even were members of staff that during the process expressed surprise about how much influence they were given. The user involvement has had great influence on the staff taking ownership to the project, and it has made them mentally prepared for the new environment before the move.

## 4. VALUE ASPECTS

This chapter on value aspects in relation to DR Byen includes 2 sections.

Section 4.1 on value concepts and value based collaboration is based on a paper with the title “Value concepts and value based collaboration in building projects”, which was presented and published in proceedings from an international symposium on Architectural Management at DTU in November 2005 (Jensen, 2005a). The text presented here has been adjusted and updated.

Section 4.2 on value management of building projects is based on parts of chapter 3 and 5 in the research report “Real Estate Strategies and Building Value” written in Danish (Jensen, 2006d). The text presented here has been translated and adapted.

### 4.1 Value Concepts and Value Based Collaboration

Value as a concept has many different meanings and usages. There is a basic difference between value in singular, expressing the worth of something, and values in plural, which has relation to personal belief and social behavior. Based on literature studies the following categories of value have been established (Graeber, 2001, Harpe, 2005, Hatch, 1997, Jensen, 2003, Pine & Gilmore and Thyssen, 2002):

1. Religious values – Values as belief system
2. Behavioral values – Values as moral and ethics
3. Economic value – Value as exchange
4. Use value – Value as utility
5. Cultural value – Value as meaning and sign
6. Perception value – Value as experience

Religious values will not be dealt with in this paper.

Exchange and use value was at the center of thinking concerning value in classic economic theory in the 19<sup>th</sup> century. In neo-classic economic theory, the theory of value of labour from the classic economical theory was neglected and value did not have a central role as a theoretical concept (Andersen & Keiding, 1997). In recent economic theory the concept of value has however got a renaissance – not least as the concept Economic Value Added (EVA), which clearly relates to exchange. Exchange value is in general the starting point for most economic thinking.

Furthermore, the concept of value has become increasingly popular in some of the literature on management – not least within strategy and marketing. Among the most well known is Porter’s theories on value chains, which like most economic theory relates to exchange value (Porter, 1985). Another example is the strategy thinking of Teece con-

cerning "non-tradeable assets" like knowledge, innovative capabilities, brands and service concepts, which relate to use value (Teece, 2003).

Within product development and design use value is also the natural starting point, although often in a combination with the exchange value and value as meaning and sign. The most interesting in this context is however the relations between exchange and use value. Essential concepts in this relation are value creation and added value.

In relation to a production process, value creation is defined as the value of the product reduced by the value of the resources used during the production of the product. The value of the product consists of the value of the resources and the added value. In classic and neo-classic economic theory the value of the product is on average equivalent to the price of the product.

Within modern marketing oriented theory there is a strong tendency to make value a completely subjectively defined concept. According to some authors product value equals customer value. It is the individual needs of the customer that define the value of the product. Similar products thus can have different value for different customers even though they may have to pay the same price for the products. There are even some authors, who claim that the value creation of a product is dependent on the products participation in the customers own value creation. Value is in these theories created jointly (co-produced value) between deliverer and customer (Ramírez & Wallin, 2000).

The apparent contradiction between objectively and subjectively definitions of value could be resolved using the definition of economic value formulated by Cook (1997). Opposite to the general understanding in economic theory that price is an expression of value, Cook's argument is that a product to be produced must have a value which exceeds its price. The difference between the price and the production cost makes up the producer's "free value" or "net value". The difference between the value and the price makes up the buyer's free or net value. Hence, both the producer and the buyer gain from the transaction.

It is remarkable that this understanding of value closely follows the understanding of value in the classic economic theory and at the same time is coherent with the fundamental market mechanism. In the theory of labour value, the basis for value creation is that labour creates more value than the cost of labour. The value of labour exceeds the price of labour. Why should this only apply to labour and not to all products? This means that the added value is redistributed to all products mediated by the market mechanism. The added value will be distributed between producers and buyers according to the relative power of supply and demand.

In relation to partnering in the building process, it is of particular interest that the fundamental transaction of exchange with this understanding is a "win-win" situation, which also is a basic aim in partnering.

Based on Cook's understanding the product value can be divided in a relatively objective use value or design value and a more subjective customer value. The design value is under market conditions expressed by the exchange value, while customer value is decisive on how the demand for potential customers is divided on competing products. In a marketing context, it is therefore important to develop a design value that is increasingly more segmented and adapted to specific groups of customers to attract a higher proportion of the potential demand – or a more exclusive part willing to pay a higher price.

There is in general a definite tendency in marketing to "undermine" the market relations by creating closer and longer lasting relations between deliverers and customers. In this way the market related transaction costs can be reduced for both deliverer and customer, leading to reduced usage of resources and increased value creation. According to Ford et al (2002) a customer can gain value in two ways: The value of the offering and the value of the relationship. The building industry has traditionally focused solely on the value of the offering. It may be about time for the industry also to gain value from relationships.

### Value and performance

A researcher from Finland refers to the four e's of performance: "Performance is a factor of the building feasibility. The four e's of performance are economy, efficiency, effectiveness and efficacy"... "Economy means doing things for low cost"...."Efficiency is doing things right, i.e. using resources well. Effectiveness is doing the right things, it is, taking into account the market demand. Efficacy means the relevance of the outcome." (Himanen, 2003).

These concepts of performance can be divided in relation to the exchange and use value and the distinction between process and product as shown in table 4.1.1. The performance concepts can be regarded as different methods of creating value.

	Exchange value	Use value
<b>Process</b>	Economize	Efficiency
<b>Product</b>	Effectiveness	Efficacy

**Table 4.1.1** Different methods for value creation

The method of economization aims at lower production cost per unit by acquiring cheaper resources or making the workforce work harder without an equivalent increase in salaries. The efficiency method aims at increasing output without increasing the use of resources by working smarter and doing things right the first time. The effectiveness method aims at the highest possible income from sales by doing the right things in relation to the demand from the market. The efficacy method aims at increasing the products fulfillment of need and user satisfaction.



The above methods mostly apply to production of goods. In delivery of services and experience the process and product aspects melt together and cannot be analyzed separately. According to Pine & Gilmore (1999) a general increase in value occurs as society develops from agriculture, to industry, to service and further on to experience and ultimately to a so-called transformation society.

An important aspect of use value creation is that business processes can both create value for the customer and internally in the production process, for instance in the form of new knowledge and other “non-tradeable” assets as mentioned earlier. This is becoming increasingly important, which the many efforts to create learning organizations illustrate. Speculative capital investments can be seen as a parallel in creation of exchange value (Sarasoja et al, 2004). Both non-tradeable assets and speculative capital investments are capabilities that aim at long term benefits.

Value creation can also take place in relation to cultural value and perception value. Cultural value includes branding and the image of companies as well as prestige and signal value for individual customers. Perception value relates to the customers experience by use of a product or participating in an event.

### **Value based management and collaboration**

A Danish working party on value management has produced a State-of-the-Art report, where the value aspect of the productivity concept is in focus. A distinction is made between an external set of values, which is defined as the customer value regarding both product and process and an internal set of values defined as the value based behavior in the delivery team (Christoffersen, 2003).

Compared with the earlier defined categories the external set of values can relate to exchange, use, cultural and perception value, while the internal set values relate to behavioral value. The external set of values are equivalent to the values which are defined by use of value management in the way the term is used in building literature in the UK (Blyth & Worthington, 2001, Green, 1996 and Kelly & Male, 1993) and in the international literature on lean construction (for instance Koskela, 2000).

Other authors use the concept value management equivalent to value based behavior and value based management. Thyssen (2002) sees values in an ethical and moral context and also makes a close link between the value base and the strategy of an organization. A value base must be developed in dialogue as part of a political process.

In relation to partnering it seems relevant to make a distinction between value based management and value based collaboration. Value based management is managing an organization based on values defined by the management, i.e. management values. Value based collaboration is a collaboration between different organizations based on values defined by the collaborating parties, i.e. collaboration values. Value based collaboration will or can include a value management process of defining the external set of values together with the end users of the building project.

A test building project of a student hostel called Limfjordskollegiet in Aalborg, Denmark had value based management as a starting point, but as the project developed the involved parties changed the terminology towards value based collaboration (Wandahl, 2002). Values were originally defined in a workshop using the concept of “future workshop” as a methodology. Starting from not preferable “anti-values” the involved parties defined the preferred values in the project collaboration, and this led to the definition of a value base included in a formal agreement of collaboration.

During the project period the values were monitored every fortnight by use of an IT-based value-web, where all parties should give their evaluation of the importance and the fulfillment of the different values by indicating a score between 1 and 5. At meetings and workshops the evaluations were discussed and actions agreed upon.

In DR Byen the project management of the client organization is utilizing value based management, and the collaboration with consulting companies and contractors is based on partnering as mentioned in section 2.2. A value base for managing the client organization in DR BYEN was defined by the project management. This was developed during seminars involving the leading members of the client’s project management organization. Similarly, the collaboration parties have as part of the partnering process defined common vision, objectives and rules for the collaboration. The example used in this paper concerned segment 3 and was developed at the beginning of the design development at a kick-off seminar with representatives from the design team and the client. The outcome was called rules of collaboration, but they are very close to the values defined at Limfjordskollegiet and the partnering collaboration can be regarded as value based collaboration.

A comparison of the value base of DR Byen’s project management and the values in the collaboration in both Limfjordskollegiet and DR Byens’s segment 3 is shown in table 4.1.2.

<b>Values on collaboration in Limfjordskollegiet</b>	<b>Values of management in DR BYEN</b>	<b>Rules of collaboration in DR BYEN’s segment 3</b>
Good collaboration	Good partner of collaboration	Collaboration should be a gain for all
Honesty and openness	Honesty + openness	Open and honest
Respect and equality	Respect for others	Respect
Keeping agreements	Timeliness	Timeliness
Joint responsibility	Professionalism	Holistic
Effective communication	Dialogue	Dialogue
Sharing of knowledge		Helpfulness
It must be good fun		Be good fun
		Self-realization
		Clear to everybody

**Table 4.1.2** Comparison of the values of collaboration in Limfjordskollegiet, the management values of DR BYEN and the rules of collaboration in DR BYEN’s segment 3 (Jensen, 2003).

The comparison shows a lot of similar values and rules for managing and collaborating. The main difference is that the value base for DR BYEN's value based project management does not include values related to personal engagement and personal gain in relation to knowledge sharing, self-realization and enjoyment, which are present in both cases of value based collaboration. The value based management mainly focuses on the values of the organization as a company, while the value based collaboration also put focus on the individual aspects of the collaboration.

This clearly indicates that it makes a difference to define collaboration values in a group based process with all involved parties. The participants start to realize their possible individual gain from the process instead of just seeing themselves as professionals representing their company.

### **Conclusion**

Based on the above mentioned methods of value creation and management of value, a set of different strategies for value creation have been identified as shown in table 4.1.3.

A focus on value creation has the advantage that it at the same time requires a holistic approach and an awareness towards what is essential for the company and its customers. Cook (1997) express it as follows: "Understanding how value is generated is vital to the development of successful products because value is the only fundamental metric which makes a positive contribution to all the other bottom-line metrics". The difficulty with the concept of value is the many different facets and aspects, and a lack of agreement on the definition and practical application of the concept.

This results show from a theoretical point of view, that the concept of value and value creation should be related to both producers and customers as well as to both processes and products. There is however a clear trend towards increased collaboration between producers and customers in value creation. This applies to business in general as well as to the building and facilities management industries.

Another trend is that products and processes are becoming more and more intertwined, particularly in the expanding areas of delivering services and experiences. This trend is one of the driving forces behind the development of facilities management as a service delivery.

Both trends are also important for the building industry. The increasing demand for involvement of the end users in the building process is an example of collaboration between producers and customers in the value creation process. However, it is also an example of the increasing need for delivering services and experiences to the customer during the process as part of the products delivered by the building industry.

The results also indicates that the practical implementation of value management in the form of value based collaboration can provide a holistic approach to building process development and building product evaluation that is promising in relation to the positive

engagement of all stakeholders in the building process and providing a more holistic product assessment compared to other methods for building evaluation.

	<b>Behavioral values</b>	<b>Exchange Value</b>	<b>Use value</b>	<b>Cultural value</b>	<b>Perception Value</b>
<b>Process</b>	Value based management	Minimize cost of resources  Maximize output with the same resources	Gradually improve process by doing things right  Radically improve process by working smarter  Improve process to create new internal knowledge		
<b>Product</b>		Maximize amount of sales by doing the right things  Maximize product prizes  Speculative capital Investments	Gradually improve product by increased functionality  Radically improve product by new functionalities	Create significant products that support company branding and customers signal value	Create products that give customers valuable experiences
<b>Process and Product</b>			Make the process part of the product by including services of value for the customer		Create events that give customers valuable experiences
	Value based collaboration				

**Table 4.1.3** Strategies for value creation

## 4.2 Value Triangles in Management of Building Projects

The focus of this section is the implementation of value triangles in the management of building projects. The aim is to develop a framework for characterizing and evaluating the project management of different building projects, and to test the framework on a number of buildings from different periods. The paper is mostly theoretical, but also presents the results from a case study, where the theoretical framework has been implemented and tested.

The conventional value triangle of quality, cost and schedule for project management is the starting point, but this is seen as mainly being related to process integrity in the construction stage. It is supplemented by a similar value triangle of cultural value, use value and quality of realisation for product integrity, mainly for the design stage. Based on this framework an evaluation is made of the value management in six of DR's building projects from the first around 1930 to the present – DR Byen.

The research was part of a project on space strategies and building values, which involved a major case study of the development of facilities for DR. The paper starts with a description of research method and aim. The theoretical part includes an introduction and discussion of the conventional value triangle, and a framework with supplementary value triangles for product integrity and process integrity is developed. The empirical part presents the results of the evaluation of the six buildings. Finally, the results are discussed, and conclusions are drawn.

### Research methods and aim

The theoretical part is based on a literature study on project management both in general and in relation to building projects. The empirical case study is based on literature studies, archive research and an interview survey. The empirical literature studies have mostly concerned publications related to DR's history from 1925 and onwards. The archive research has supplemented the empirical literature studies and has included studies of archives at DR's internal library and archive as well as archives on some of DR's major building projects at the Danish National Archive (Rigsarkivet). The interview survey has involved 12 interviews with former managers in DR and former consultants for DR.

The research is based on a huge amount of empirical material about the case study. This paper only includes a brief summary of the results of the evaluation of six building projects from different time periods.

The research aims to contribute to the development of a theoretical and empirical understanding of the management of the building project and the use of the concept of value in this context.

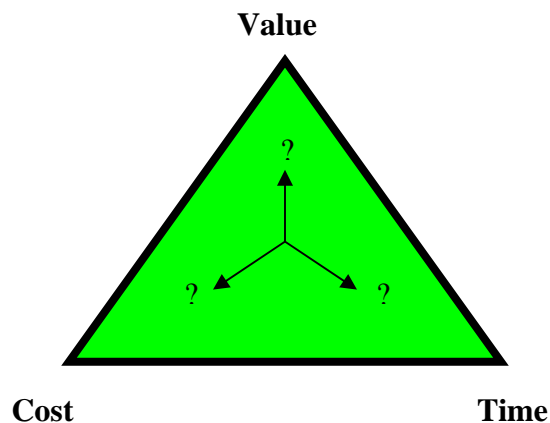
### Theory on value triangles in project management

In the literature of project management it is common to see the objective as optimizing the outcome in relation to cost and time. The relationship between these three factors is sometimes described as the project management triangle (Wikipedia, 2007), the triple

constraints or the value equation (Verzuh, 2003). The outcome is described in terms like scope (Wikipedia, 2007), benefit and quality (Verzuh, 2003), and function, specification and performance (Engwall, 1995). In the following the term “value” will be used for the outcome and the value triangle for the relationships.

A project that keeps within budget and schedule, and results in a product of high value is typically regarded as a success. The challenge in the planning of a project is to create the equilibrium between the three factors. The value of the product depends on how much time and money one is willing to invest. When this balance has been fixed, a change in one factor will influence the other two factors.

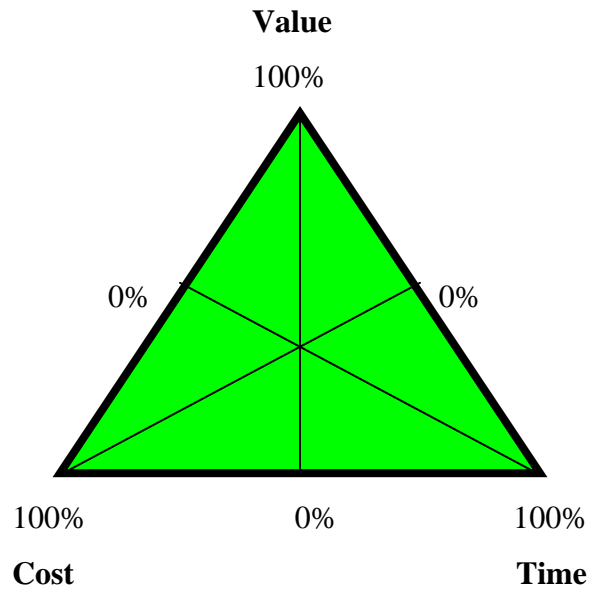
According to Engwall (1995), the relationship between the three factors can be illustrated as an equilateral triangle stretched between value, cost and schedule in each corner as shown in figure 4.4.1.



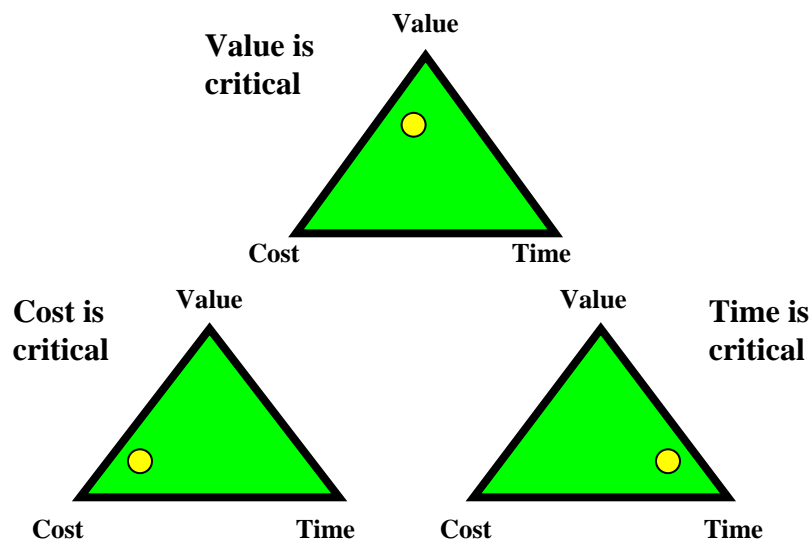
**Figure 4.2.1** The conventional value triangle (Briner et al, 1991 and Engwall, 1995)

The triangle could be seen as having three axes, which can be used to indicate the priority of each factor. This is illustrated in figure 4.4.2. The sum of the priorities necessarily has to be 100%. If all factors are given equal priority, then the centre of gravity will be the third on each axis, i.e. a priority of each by 33,3 %.

Different projects will have different centres of gravity in the triangle. This is illustrated in figure 4.2.3 with the three extreme situations, where value, cost or time is the dominant factor, respectively. Concert halls and nuclear power plants can be mentioned as examples of projects, where value is the critical factor, because the functional aspects are dominant. Production buildings and social housing projects are often very cost critical, while the schedule is extremely critical for facilities for sports events like the Olympic Games with a clear deadline.



**Figure 4.2.2** The value triangle with axes of priority



**Figure 4.2.3** Value triangles for projects with extremely different priorities

The total value of a project consists of the resources (cost and time), that are used in the project, and the added value, that is created as a result of a successful project. When the project goal is set one must define the value that the project should result in and the resources available for the project. An implicit part of the goal normally is an expectation that the value should be optimized in relation to the use of resources, and therefore the

value creation should be maximized. Thus, a primary task for the project management is to secure an effective value management and an efficient resource management.

#### *Implementation and innovation projects*

Verzuh (2003) emphasizes, that the priority between the three factors in the value triangle should take place in the project definition phase, before the decision to start a project. According to this view the priority should not be made by the project organization but by the client or sponsor, who makes the decision to start the project. Engwall (2002) distinguishes between implementation projects and innovation projects as described in table 4.2.1. In implementation projects the project goal is exogenous to the project organization, and this is equivalent to the view of Verzuh (2003) with project goals defined by the sponsor. In contrast, the definition of the project goal is endogenous for innovation projects, i.e. it is a part of the work in the project organization to define the project goal and set the priorities.

	<b>Implementation project</b>	<b>Innovation project</b>
Pre-knowledge	Complete	Incomplete
Project goal	Exogenous to the project work	Endogenous to the project work
Knowledge Development	During preparation	During preparation and during the project development
Result	Final product	Final product and knowledge about the project goal and the process to reach it
Rationality	Efficient delivery of the result	The right knowledge about the result

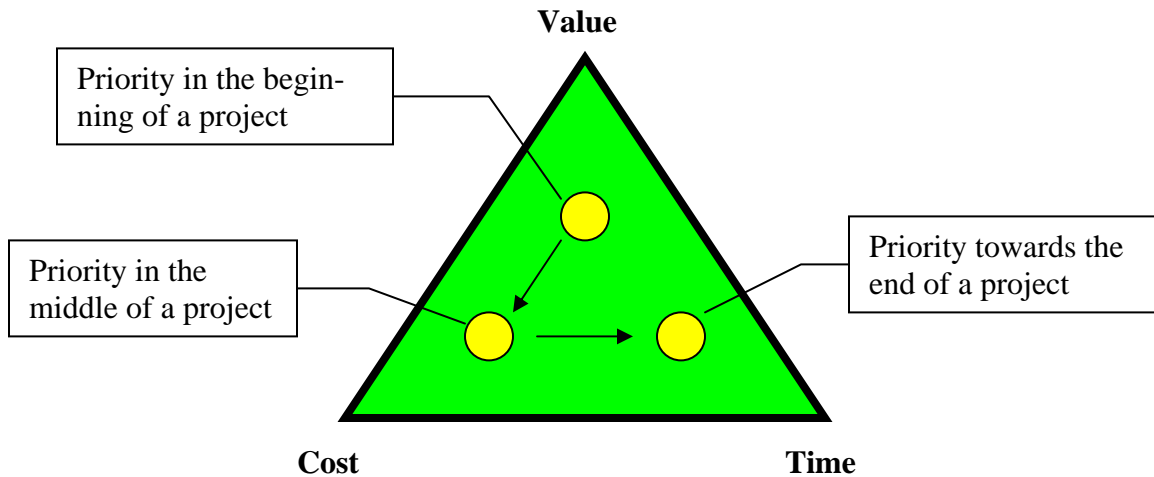
**Table 4.2.1** Implementation and innovation projects (Engwall, 2002 – my translation)

Building projects can be either an implementation or an innovation project or a combination of both. A small, standardized building project can be regarded as an implementation project, while large and complex building projects can be seen as innovation projects. That is particularly the case in the early stages with briefing and conceptual design. Construction based on a detailed design can contrarily be regarded as an implementation project.

#### *Changes in priorities*

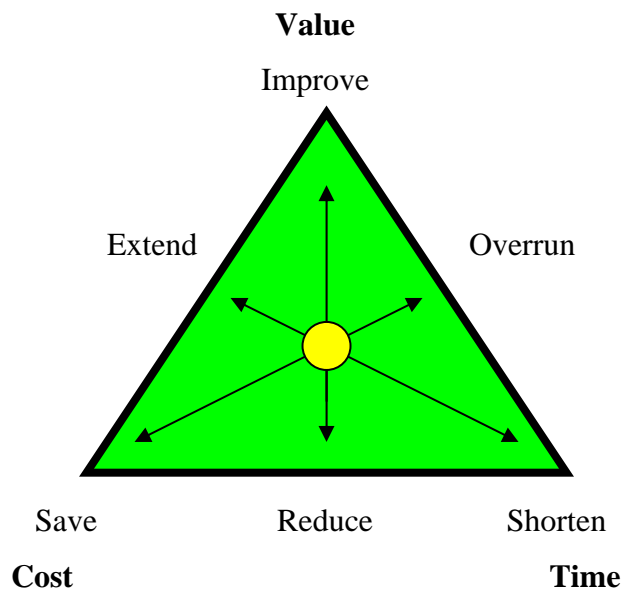
During a project the focus and therefore also the priorities between the three factors in the value triangle will often change over time. In the beginning the definition and fulfilment of the value will be the primary focus area. As the project develops, the budgetary strains will become more present and this will change the focus towards keeping the budget and perhaps make savings to avoid overrun. Towards the end the deadline comes closer, and keeping the schedule becomes the main priority. This typical development in the priority is illustrated in figure 4.2.4.





**Figure 4.2.4** Typical development in the priorities in a project over time

When the priority between the three factors in the value triangle has been made, it can be useful to change the axes to have the starting point in the centre of the triangle as shown in figure 4.2.5. By this illustration it becomes clearer, how changes in the priority to the benefit of one factor will influence one or both of the other factors negatively.



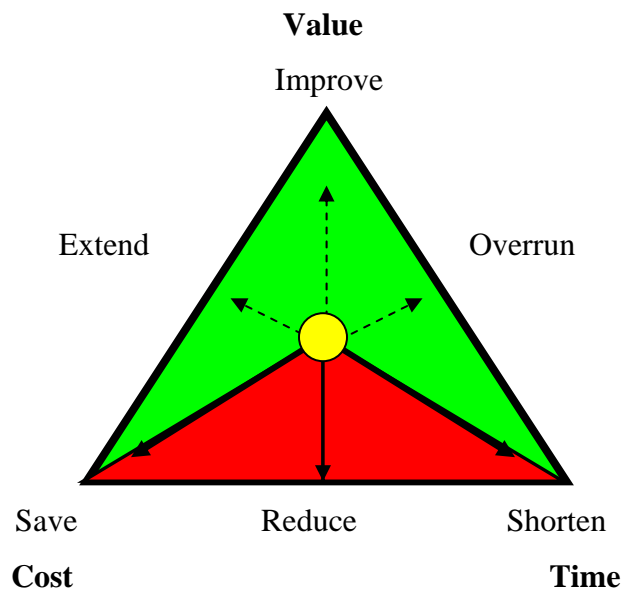
**Figure 4.2.5** The value triangle with priority fixed in the centre

Some of these relationships can be problematic. By extending the schedule it may be possible to improve the value – particularly if the project is delayed - but it is doubtful whether it gives possibilities to save cost. For building projects the cost of running the

building site will for instance usually increase, if the schedule is extended. Contrarily, it often increases cost, if the schedule is forced to be shortened. Therefore, the value triangle should not be regarded as an expression of some kind of absolute law, but only as a general illustration of principles for the relationships and priorities between the three factors.

#### *Example about DR Byen*

The use of the value triangle can be illustrated by an example from DR Byen. When the project was started in 1999 it was decided by DR's board, that it should be built within a budget of maximum €400 million (DKK 3,0 billion) in the price level of 1999. A deadline for the project was stipulated as well. With these preconditions two of the three factors in the value triangle were fixed in one direction as shown in figure 4.2.6.



**Figure 4.2.6** The value triangle for DR Byen

The room for changing priorities during the project is reduced to the third part of the triangle marked as the darkest (with red colour). This means that there in principle only are the possibilities to reduce value, save cost and/or to shorten the schedule. A building project like DR Byen is very much an innovation project. Even though the budget and deadline was defined exogenous by DR's board, the value definition was at that stage only defined rather vaguely, and an important part of the project was to define the value more specifically and develop knowledge about the project.

One of the great challenges in the project management is that most external parties involved in the project have an economical interest in increasing value and thereby the cost of the part of the project, that they are involved in – even though that may be on the expense of the total budget or other parts of the project. Therefore, it is a crucial part of the

management task continuously to prioritize the solutions in each of the different parts of the project and make sure that they stay within budget.

Fixing the budget and the deadline can be seen as a strait-jacket for the project management, but it can also have the advantage that it gives a clear objective and thereby a clear focus for the management – to optimize value within a set budget and deadline. It can be regarded as contradictory to define clear objectives for cost and time without a specific definition of the value. On the other hand, the typical development of building projects is suitable for a gradual detailing of the specification of the value objectives.

For the project management it can be an advantage to have a well defined budget and deadline. It increases the legitimacy, when a request to increase the value is refused. If it was possible to increase the budget or the value, the project management may have to accept to use time and energy to investigate various suggestions to increase the value and prepare decision proposals to change the project, which can disturb the smooth running of the project. Therefore, it should never be too easy to change the project goals and objectives – and it should be more difficult the later in the project period it occurs.

It is of course a problem, if the cost and time limitations do not allow the value objectives to be fulfilled in spite of all the possibilities for adjustments that are made. In such a case the objectives for the three factors in the value triangle have been defined unrealistically without the necessary balance, and they will have to be redefined. That is what happened in DR Byen, and it meant that the budget had to be increased, and the deadline postponed.

#### *Product and process integrity*

The English construction management researcher Graham Winch (2002) has by inspiration from the product development in the car industry created a model for product integrity or the quality of intention as shown in figure 4.2.7.

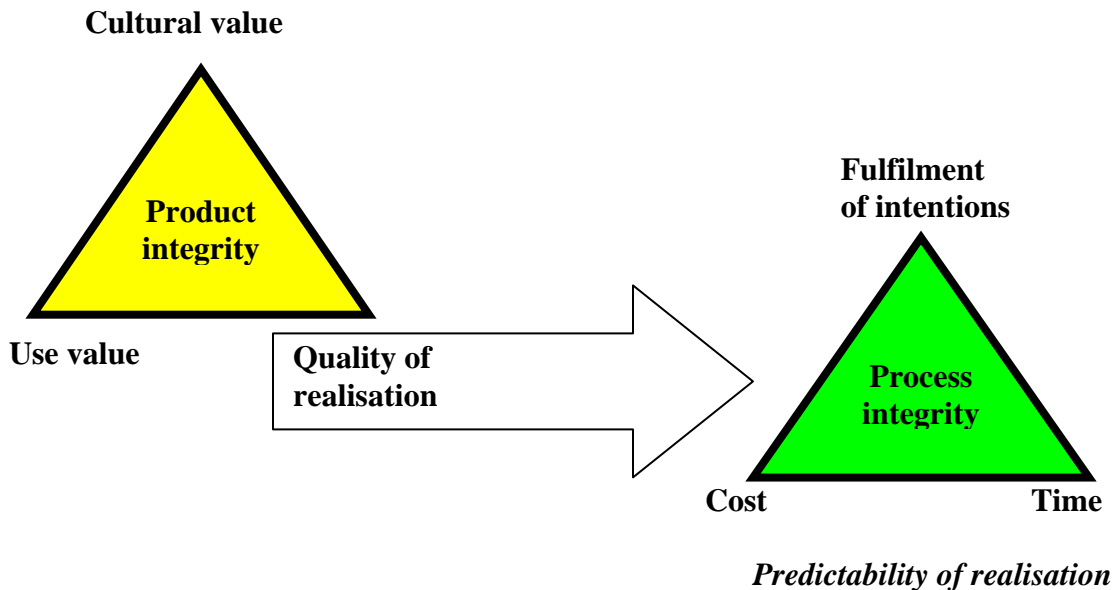


**Figure 4.2.7** Model for product integrity – quality of intention (Winch, 2002)

The quality of conception expresses the symbolic aspects in terms of elegance of form, spatial articulation and contribution to the urban culture. The quality of specification expresses the functional aspects in terms of the fit and finish desired, and the fitness for purpose of the completed facility. The quality of realisation expresses the resource and process aspects in terms of budget, schedule and the service delivery experience.

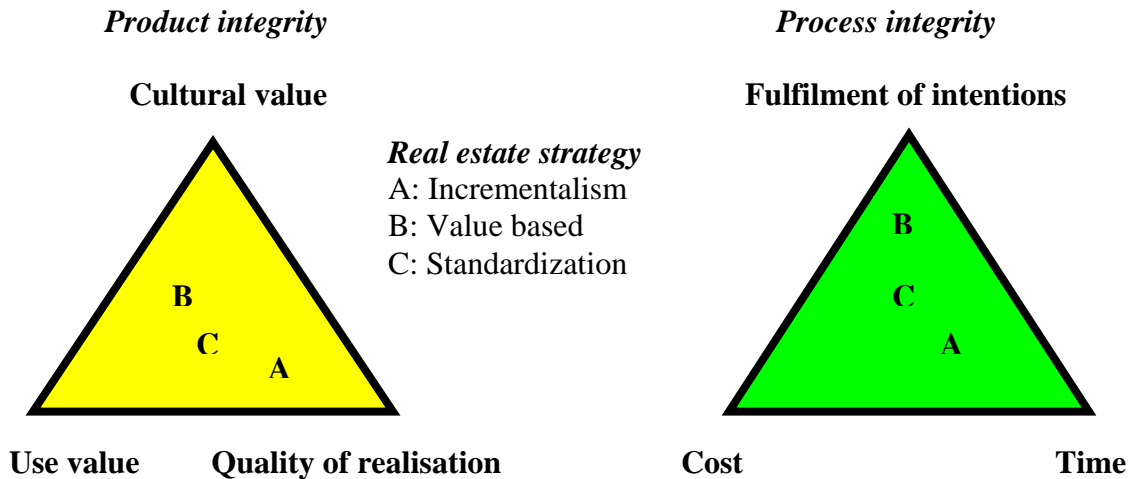
Winch connects the model for product integrity with a model for process integrity, which is near enough identical with the value triangle presented earlier. The product integrity concerns an appropriate intention, while the process integrity concerns a predictable realisation. This is shown in figure 4.2.8. The terms “Quality of conception” and “Quality of specification” have been replaced by “Cultural value” and “Use value”.

*Appropriate intention*



**Figure 4.2.8** Models for product integrity and process integrity (based on Winch, 2002)

The differences between the three real estate strategies presented in chapter 2.1 could be illustrated by these models as shown in figure 4.2.9. A strategy of incrementalism has in relation to product integrity a dominant focus on the quality of realisation, and in relation to process integrity short time is the most important factor. A value based strategy has in relation to product integrity focus on the value aspects – both cultural and use value, while the quality of realisation has low focus and from that also follows a low focus in relation to process integrity on both cost and time. A strategy of standardization is in relation to product integrity characterized by a stronger focus on use value compared to cultural value, but the quality of realisation is also important, and in relation to process integrity, that goes for both cost and time.



**Figure 4.2.9** Real estate strategies in relation to product and process integrity

According to the models for product and process integrity there are two main factors in the value management: Cultural value and use value. Similarly, there are two main factors in the resource management: Cost and time. Value creation in project management includes both value management and resource management.

### Empirical results

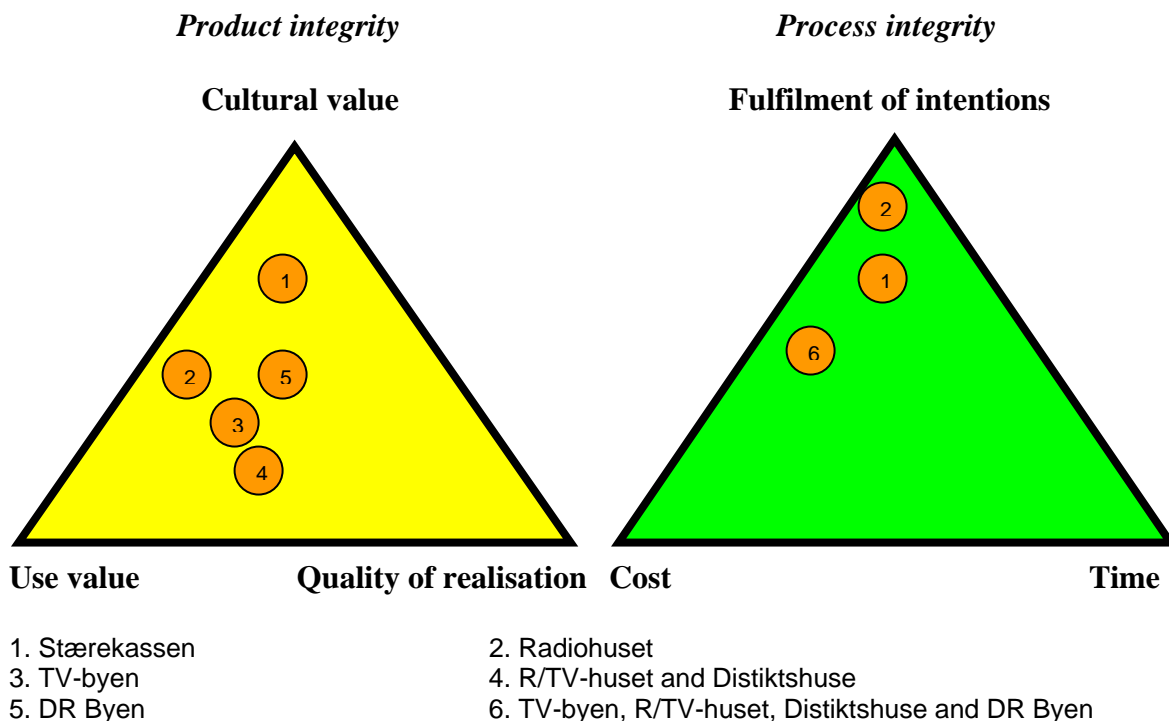
The six building projects that have been investigated and evaluated are mentioned in table 4.2.2. They constitute the most important building projects undertaken by DR since its start in 1925, and differ very much in size and the time they were built.

Estate/building	Locality	Period of DR's occupation	Area
Stærekassen (Nickname: Birds nest)	Copenhagen (with the Royal Theatre)	1931-1941	6.000 m <sup>2</sup>
Radiohuset (Radio House)	Frederiksberg (near Copenhagen city)	1941-2007	30.000 m <sup>2</sup>
TV-byen (TV town)	Gladsaxe (North of Copenhagen)	1964-2006	100.000 m <sup>2</sup>
R/TV-huset (Province radio/TV-centre)	Århus (in Jutland)	1973-	28.000 m <sup>2</sup>
Distriktshuse (Regional radio centres)	Odense, Vejle, Ålborg (3 province towns)	1983-	Each 2.600 m <sup>2</sup>
DR Byen (DR town)	Copenhagen (new development - Ørestad)	2006-	130.000 m <sup>2</sup>

**Table 4.2.2** The buildings included in the case study

The result of the evaluation of the six building projects in relation to the models for product and process integrity is shown in figure 4.2.10. The oldest building – Stærekassen – is

the most extreme with a very dominating focus on cultural value. The reason for this was that the building was adjacent to the Royal Theatre and mainly built to provide an extra theatre hall with the remaining space meant to be used by DR. However, the building was not suitable for radio production – for instance due to bad sound insulation between the theatre hall and the radio studios. The project was a big scandal at the time, and the planning of Radiohuset started only a few years after Stærekassen was occupied.



**Figure 4.2.10** Evaluation of DR's buildings in relation to product and process integrity

Radiohuset from around World War II had a very strong focus on both cultural and use value and had the most dominant focus in the fulfilment of intentions. It has for 65 years served as DR's main radio centre and concert hall, and is today a preserved building as one of prominent examples of modernist architecture in Denmark. TV-byen from the 1960's and 1970's had stronger focus on use value and the quality of realisation – particularly in relation to cost.

The buildings R/TV-huset and distriktshusene from the 1970's and 1980's had the least focus on cultural value and most focus on the quality of realisation. Among the reasons are that they were built after DR had established an internal building client, and the buildings were not headquarters. The new headquarters DR Byen is seen as having the most equal balance between the factors in relation to product integrity, while the process integrity is evaluated to be the same for all the building except the two oldest with a stronger focus on the fulfilment of intentions.

## Conclusion

The conventional value triangle of project management should not be regarded as an expression of some kind of absolute law, but only as a general illustration of principles for the relationships and priorities between the three factors of value, cost and time. Winch (2002) provides a more differentiated picture by substituting the conventional value triangle by a model with a triangle for product integrity and a triangle for process integrity. With this model the possibilities to discuss the value of a project is improved by introducing the distinction between the quality of conception and quality of specification - or cultural value and use value. Thereby it provides a more realistic view on the tasks and challenges project management.

Project management involves the two interrelated tasks of value management and resource management. Value management aims at effectiveness in maximizing the value output of the project within the resource constraints by defining appropriate intentions and maintaining product integrity with the right balance between cultural value, use value and the quality of realisation throughout the project. Resource management aims at efficiency by minimizing the resource input into the project by developing a predictable realisation and maintaining process integrity with the right balance between fulfilment of intentions, cost and time throughout the project. All together project management aims at reaching the project goals and optimizing performance by developing and maintaining project integrity with the right balance between value management and resource management throughout the project.

The framework with models of product and process integrity has been implemented in an evaluation of six of DR's buildings. The general picture is that DR's buildings have a strong focus on value and fulfilment of intentions. This is not surprising as DR is a public service broadcasting corporation. This means that the buildings on the one side has to be high-tech production facilities and on the other side shall represent a cultural institution of national importance. The high priority of value and fulfilment of intentions was particular significant in the two oldest buildings, which included a theatre hall and a concert hall, respectively. The recent development, DR Byen, also includes a concert hall and even though DR Byen is evaluated as having fairly well balanced product integrity, the development of the project has shown that the ambitions of DR's building committee in relation to the architectural expression of the concert hall increased over time. The evaluation was made during spring 2006 before information of severe budget overruns and delays mainly regarding the concert hall became known.

The study indicates that the value triangles provide a useful framework to evaluate and discuss the characteristics of building projects. It is a tool that can help to give a better understanding of the differences between different projects and be used to identify the particular challenges for the project management in a specific project.

## **5. BUILDING EVALUATION**

This chapter on building evaluation includes 2 sections.

Section 5.1 on manager's evaluation of DR's buildings is based on chapter 8 in the research report "Real Estate Strategies and Building Value" written in Danish (Jensen, 2006d). A paper with the title "General managers' and building managers' different evaluation of building value and quality - as built and over time" was presented and published in proceedings from the CIB World Congress in Cape Town in May 2007 (Jensen, 2007a). The text presented here has been adjusted.

Section 5.2 on post occupancy evaluation of DR Byen is based on a research report written in Danish (Jensen, 2007c). The text presented here has been translated and adapted.

### **5.1 Manager's Evaluation of DR's Buildings**

During the last 20 years a number of methodologies to evaluate the quality of buildings have been developed. These methodologies can be classified in two groups. One group is characterized by aiming at objective measurements of the quality of buildings, while the other group is characterized by aiming at measuring stakeholders' subjective evaluation of the quality of buildings. In the following the first group is called objective-oriented methodologies and the second is called stakeholder-oriented methodologies.

Among the first objective-oriented methodologies was Building Appraisal, developed by the British architects and planners DEGW in the mid 1980'ties. According to Duffy (1997) the background was a need to fill the gap between potential tenants and building owners. The technique was to test whether the spatial needs of particular types of office users could be met by typical floors of proposed or real office buildings. Among the key physical variables are image to outsiders, the capacity to accommodate high or low numbers of cellular offices, the ease with which support space can be accommodated, and the capacity of the buildings services to absorb and distribute information technology.

A comprehensive objective-oriented system called Building Quality Assessment (BQA) was developed at the University of Victoria in Wellington, New Zealand and the system was introduced in Europe in 1995 after adaptation to the European market by the Building Research Establishment in the UK. The system aims at objective evaluation and comparisons of the quality of buildings from a user viewpoint. The evaluation includes 137 different factors divided in 9 categories. Each factor is evaluated on a scale from zero to 10 with defined quality criteria for the different levels (Williams, 1999 and 2000).

Another very comprehensive objective-oriented system called Serviceability Tools and Methods (STM) was developed at the International Centre for Facilities in Canada (Davies, 1993). The principles are similar to BQA but STM is distinctive by including methods to evaluate both the demand and supply side and with particular focus on serviceability. However, the great complexity of the system has restricted the practical use of STM



(Klammt, 1998). Recently, some of the principles of STM have been introduced in the development of a conceptual framework for Performance Based Building (PeBBu) in a EU funded project carried out by CIB in collaboration with the International Centre for Facilities in Canada (Szigeti and Davies, 2005).

In Norway the consulting engineering company Multiconsult has developed some less comprehensive objective-oriented systems. One of these is a system to evaluate the conditions of buildings divided into technical condition, functionality and indoor climate. This system is based on a Norwegian standard on building conditions (Multiconsult, 2000 and Jensen, 2006c). A more recent system is called Strategic Building Analysis, which focuses on evaluation of the functionality and the adaptability of buildings. The system has been used to evaluate a number of mainly public buildings in Norway and is also being used to evaluate hospital buildings in the Netherlands (Multiconsult, 2006).

The stakeholder-oriented systems include various types of user satisfaction evaluations. In DR (Danish Broadcasting Corporation) such an evaluation was made as early as 1973 after receiving complaints from the users after occupation of a new high-rise office building. All employees present during a specific period in the new building were interviewed as well as all employees in an existing building for comparison (Jensen, 2006b). This kind of Post Occupancy Evaluation (POE) has more recently been elaborated theoretically and developed practically for instance by the American researcher Preiser (1989).

Another type of stakeholder-oriented method has been developed in Australia and is based on a visual inspection tour with a group of users through the building in question. The method is called “a generic evaluation process” and it is managed by professional facilitators. The method includes an introductory meeting, touring interview and review meeting (Kernohan et al, 1992 and Jensen, 2002).

In Denmark the State Building Research Institute has developed methods involving a number of different stakeholders’ evaluation of the quality of buildings – particular in relation to housing. One of the research projects included evaluations by building clients, architects and building users based on interviews with the aim to define a set of common quality parameters (Frøbert Jensen and Beim, 2003).

A more holistic approach to a stakeholder-oriented evaluation is being developed as part of the joint CIB and EuroFM project on Usability of Workplaces (CIB W111 – earlier TG51). A first report, including 5 case studies from different European countries, has been published (Alexander, 2005). One of the cases concerns evaluation of a University College in Norway and the study included a number of different methods: Workshop, walk-through, interviews and questionnaire survey involving both staff and students (Hansen et al, 2005).

The methodology presented in this paper is also a stakeholder-oriented approach but it has also been inspired by some of the objective-oriented systems. The focus is specifically on the decision-makers in relation to corporate buildings. The research has been part of a project on real estate strategies and building values based on a case study of the cor-

porate buildings of DR and the paper presents some of the results from a questionnaire survey among select groups of managers in DR concerning their evaluation of 5 buildings.

The overall purpose of the survey was to evaluate the different buildings' values and quality, both as built and over time. A second purpose was to develop and test a methodology to describe the values and quality of buildings at a general but still nuanced manner. The respondents were evenly distributed on general managers and building managers and a third purpose was to investigate the differences in the evaluations between these two groups. General managers and building managers are regarded as being of particular importance as they often are the most influential corporate decision makers in relation to buildings.

The paper presents the general results of the survey with focus on the differences between the evaluations of general managers' and building managers' views on the values and quality of corporate buildings. The survey is documented fully in a project report in Danish (Jensen, 2006b).

### Methodology

The evaluation concerned 5 different buildings/developments belonging to DR. The buildings are presented in table 5.1.1. The buildings are of very different age. The oldest – Radiohuset - was built around World War 2, while the most recent - DR Byen - was under construction in 2005, when the survey was undertaken. Most of the new building has been occupied during 2006 and the two oldest buildings – Radiohuset and TV-byen - have been sold and will be vacated by DR.

DR Byen replaces Radiohuset and TV-byen as DR's headquarters in Copenhagen. The other two remaining buildings are placed outside Copenhagen. R/TV-huset is placed in Århus – the next largest city in Denmark, while Distriktshuse are three identical buildings for regional radio in other province cities.

Building	Location	Period of DR's occupation	Space (approx.)
Radiohuset	Frederiksberg (close to Copenhagen city)	1941-2007	30.000 m <sup>2</sup>
TV-byen	Gladsaxe (10 km north of Copenhagen city)	1964-2006	100.000 m <sup>2</sup>
R/TV-huset	Århus (Jutland)	1973-	28.000 m <sup>2</sup>
Distriktshuse (3 buildings)	Odense (Funen), Vejle and Ålborg (Jutland)	1983-	Each 2.600 m <sup>2</sup>
DR Byen	Copenhagen (close to city)	2006-	130.000 m <sup>2</sup>

**Table 5.1.1** The building included in the evaluation

The evaluations were based on the respondents' answers to 12 closed and 2 open questions on each building. The closed questions were evaluated on a scale from 1 to 5 and concerned aesthetics divided into timeless quality and quality related to the period the buildings were designed, support of corporate image, level of standard, functionality, comfort, extensibility, adaptability, durability, sustainability, worthiness of protection and overall evaluation. The definitions of these factors are shown in text box. The 2 open questions are also included, but the answers to these questions are not presented in this paper.

#### **Explanation of the questions on the quality of buildings in the survey**

**1. Aesthetics, timeless**

The building's architectural quality seen in relation to comparable buildings (Danish institutional and domicile buildings) independent of the time of erection.

**2. Aesthetics, period**

The building's architectural quality seen in relation to comparable buildings (Danish institutional and domicile buildings) erected during the same period of time.

**3. Support of corporate image**

The building's appearance as a symbol of the corporate brand.

**4. Standard**

The building's general level of quality as a physical product (poor – luxurious).

**5. Functionality**

The building's suitability in relation to the functions it is/was designed for.

**6. Comfort**

The building's indoor climate and comfortability as a place for work and stay.

**7. Extensibility**

The ability of the original development plan to accommodate future needs for space.

**8. Adaptability**

The building's ability to be adapted to other usages.

**9. Durability**

The building's ability to resist physical deterioration over time.

**10. Sustainability**

The building's environmental quality in relation to minimizing resource usage and pollution.

**11. Worthiness of protection**

The building's importance as a part of the national heritage.

**12. Overall evaluation**

Your personal evaluation of the building.

**13. Which aspects of the building do you regard as most positive**

Write in your own words the specific aspects that you regard as most positive.

Furthermore, the respondents were asked to prioritize the quality factors on a scale from 1 to 11 and indicate how well they know the different buildings on a scale from 1 to 5.

In the analysis the quality factors were grouped into cultural value and use value and into quality as built and over time as shown in table 5.1.2. The concept of value is discussed in Jensen (2005a).

	<b>Quality as built</b>	<b>Quality over time</b>
<b>Use value</b>	Standard Functionality Comfort	Extensibility Adaptability Durability Sustainability
<b>Cultural value</b>	Aesthetics, period Support of corporate image	Aesthetics, timeless Worthiness of protection

**Table 5.1.2** The quality factors divided according to use value and cultural value and according to as built and over time

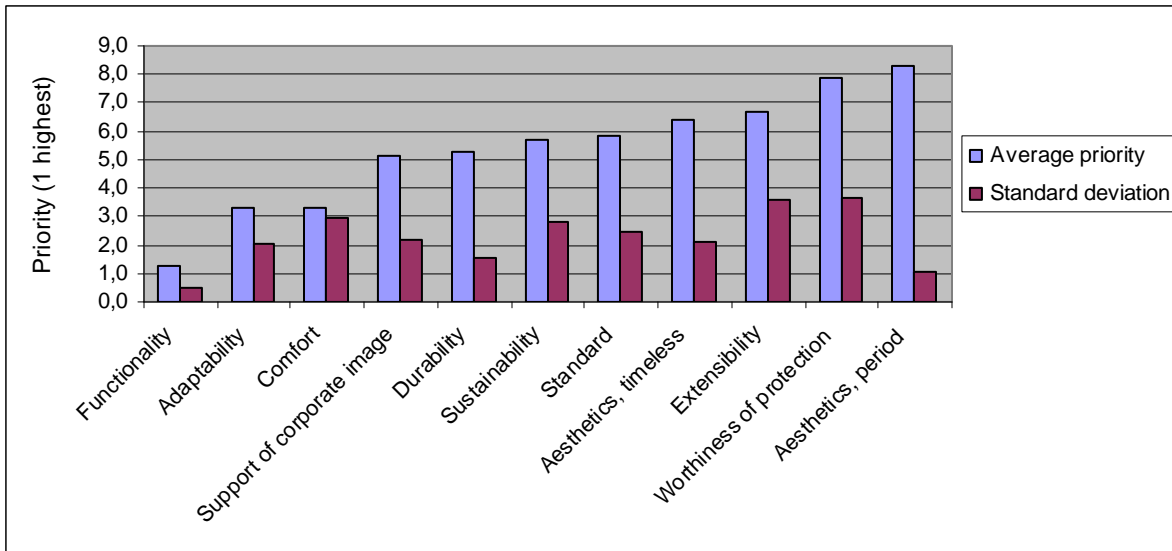
The questionnaire was sent to 10 potential respondents out of which 5 were present or former building managers and 5 were present or former general managers in DR. Answers were received from 8 respondents with 4 in each group.

The number of actual respondents is very limited but so was the number of potential respondents. Considering this the number of respondents was satisfactory, especially as the number of respondents in each group was the same. However, the number of respondents is insufficient to reach any sort of statistical evidence. Therefore, the survey can only be regarded as a pilot study and the results of the survey can only be seen as indicative.

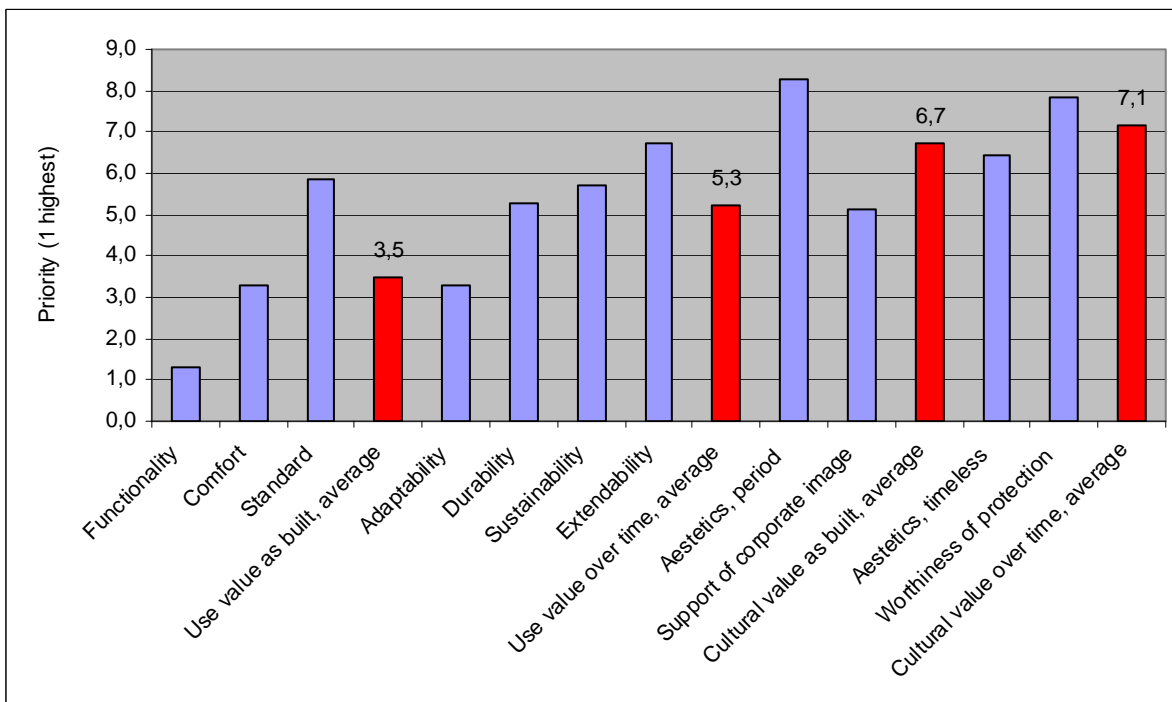
### **Results on priorities**

The results of the respondents' answers to the priority between the quality factors are shown in figure 5.1.1 together with the standard deviation for each factor. Please note that 1 indicates the highest priority. Not surprisingly, functionality is given the highest priority with a very small standard deviation. This means that there is a high degree of agreement on this priority. Next follows adaptability and comfort which have almost the same priority, but comfort has a higher standard deviation. The lowest priority is given to aesthetics in the period and next lowest is worthiness of protection.

In figure 5.1.2 the priority is divided according to the four groups in table 5.1.2. From figure 5.1.2 it can be identified that the two groups concerning use value has a much higher priority on average as the two groups concerning cultural value. Similarly the groups concerning value as built have a higher priority than the groups for value over time for both use value and cultural value.

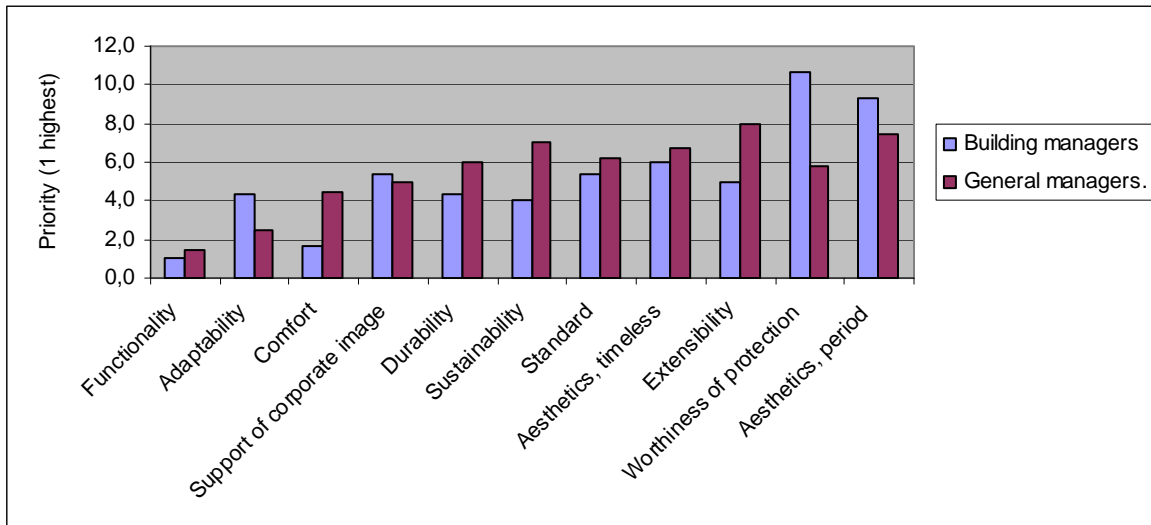


**Figure 5.1.1** Priority of quality factors



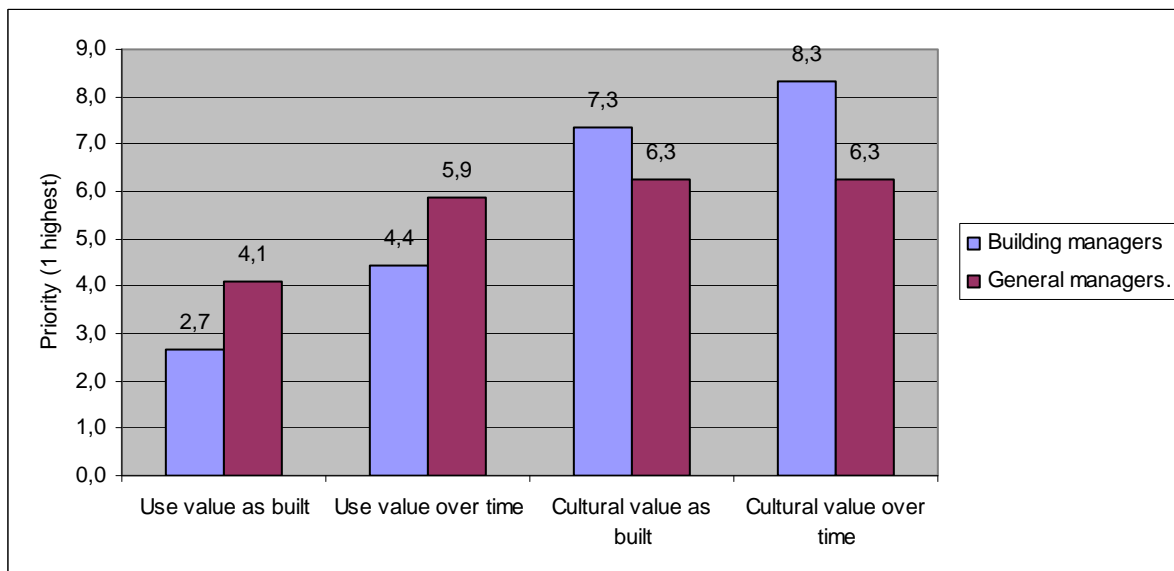
**Figure 5.1.2** Priority of quality factors in groups

In figure 5.1.3 the priorities are divided according to the managers' responsibility. Some clear differences in the priorities can be identified. The building managers give higher priority to comfort, sustainability, extensibility and durability than the general managers. On the other side general managers gives higher priority to worthiness of protection, adaptability and aesthetics during the period.



**Figure 5.1.3** Priority of quality factors according to responsibility

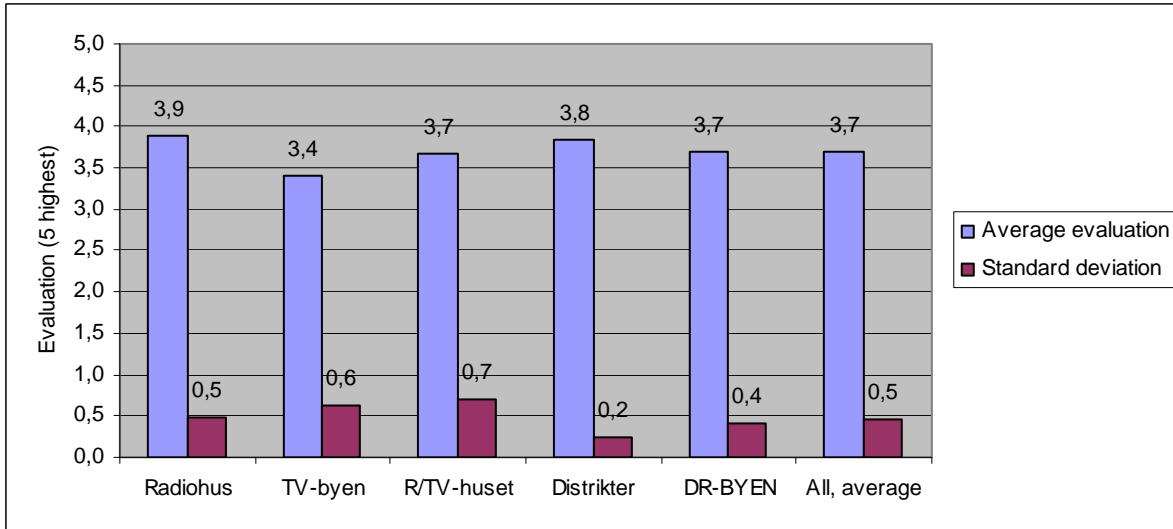
When grouped together according to table 5.1.2 as shown in figure 5.1.4 it becomes clear, that building managers give higher priority to use value both as built and over time than general managers, while the general managers give higher priority to cultural value both as built and particularly over time than building managers. However, both groups give higher priority to use value than to cultural value – as built as well as over time.



**Figure 5.1.4** Priority of quality factors according to responsibility and in groups

### Evaluation of the buildings

The average evaluation of each of the five buildings is shown in figure 5.1.5 together with the standard deviation. Please note that the highest possible evaluation here is 5. Not all buildings were evaluated by each respondent.



**Figure 5.1.5** Evaluation of each building on average with standard deviation

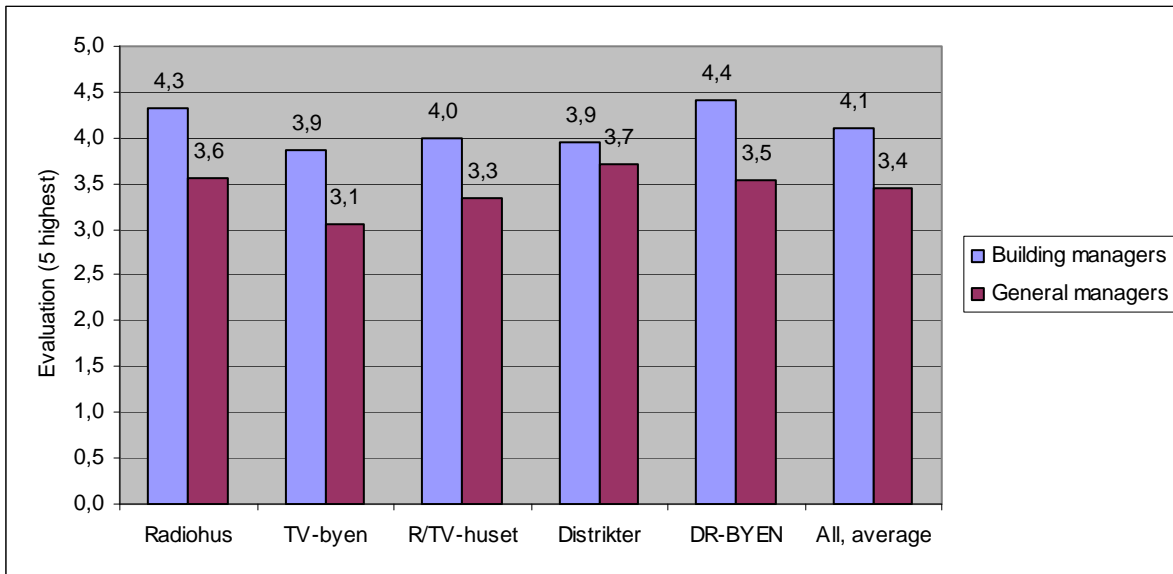
The oldest building – Radiohuset – was rated highest with 3,9, while the next oldest – TV-byen - was rated lowest with 3,4. A detailed analysis reveals that the main reasons for these differences are due to major variations in the evaluation of the cultural value. In fact, the oldest building has the highest rating of cultural value and lowest rating of use value of all 5 buildings, while the next oldest building is the only one with a higher rating of use value than cultural value. The new headquarters – DR Byen – was rated on the average of 3,7, but the evaluation of DR Byen is rather uncertain as the building was under construction during the survey.

The standard deviation was highest for R/TV-huset and for this building only there was a clear relation between the different respondents' evaluation and how well they know the building. Those who know the building well evaluated it better than those who know the building less. The building's architecture is dominated by in-situ cast concrete facades.

The results shown in the diagrams are not weighted in relation to the priority of the quality factors. With weighting the differences in the rating between the buildings will decrease.

The evaluations of each building differentiated according to responsibility are shown in figure 5.1.6. There is a very clear difference between the evaluations with building managers rating all building considerable higher than the general managers. In average building managers rate the 5 buildings with 4,1, while the general managers rate the buildings 0,7 lower with 3,4. As the difference between the highest and lowest rating of the differ-

ent buildings in figure 5.1.5 was only 0,5 it becomes clear that the differentiation in the rating is related more to responsibility than to differences between the buildings.



**Figure 5.1.6** Evaluation of each building according to responsibility

### Summary

The results presented above can be summarized as follows.

Of the 11 quality factors functionality is given highest priority by both general managers and building managers. General managers give much higher priority to adaptability, aesthetics in the period, and worthiness of protection than building managers. Contrarily, building managers give much higher priority to comfort, sustainability, extensibility, and durability than general managers.

In general, quality factors related to use value are given higher priority than quality factors related to cultural value. Similarly, quality factors related to value as built are given higher priority than quality factors related to value over time.

Building managers give higher priority to use value than general managers, while general managers give higher priority to cultural value than building managers. However, both groups give higher priority to use value than to cultural value – as built as well as over time.

The results of the evaluations of the buildings in question show that the differences in the responsibility of managers cause larger differences in the ratings than the differences between the ratings of the different buildings.



The building managers rate each of the buildings much higher than the general managers. This can be interpreted as the building managers professional affinity to buildings means that they find buildings of greater importance than general managers.

### **Discussion**

It is important that building and facilities managers are aware of these differences in the priorities and attitudes between themselves and their corporate general managers. They should in their communication with top managers about investments and other decisions related to building not put too much focus on the use value aspects except for functionality and adaptability and instead stress the cultural impact like the importance of aesthetic qualities in relation to the corporate image.

For architects and others who wants to collaborate with corporations it is also important to be aware of the differences between the two important groups of decision makers. In their communication with general managers they should mainly focus on functionality, adaptability and the cultural aspects to sell the project. In their often more day to day collaboration with building and facilities managers they should mostly focus on the use value aspects, including comfort, sustainability, extensibility and durability besides the fundamental functionality factor.

The results in this paper are based on a small survey among select groups of managers in one corporation. Therefore, it must be regarded as a pilot study. Even though the results only can be regarded as indicative, the differences between the evaluation of building managers and general managers are very clear and the implications are seen as important.

The methodology has proved to be working well and can easily be used by others. Further work to refine the quality factors and their relations to value concepts could be useful. It would be interesting to see the results of similar studies from other countries and in relation to other types of companies and buildings.

## **5.2 Post Occupancy Evaluation of DR Byen**

This section presents an evaluation of DR Byen after occupation based on an interview survey among managers and staff in DR. The evaluation concerns both the buildings as work environment, the involvement in the planning process and the fulfilment of the vision. The investigation aims at gathering the experiences from the building project, and the research has been carried out in collaboration between BYG-DTU and DR's client organization.

One of the objectives of the evaluation is to clarify to which extent the intentions, requirements and expectations to the use value of the buildings have been fulfilled. Another objective is to identify what could have been done to increase the use value, and what possible adjustments can be made to improve the buildings. In a wider sense the purpose is to contribute to the development of methods to evaluate the use value of buildings and to utilize the experiences from DR Byen in improving future building projects.

The evaluation concerns the generally usable spaces in DR Byen with main focus on the workplaces in open environments and the common areas like cafés, atria, the Internal Street, staff restaurant, meeting areas and service facilities. Special rooms like studios and editing suites are not evaluated as such, but the relationships between the open environments and the special rooms can be part of the evaluation.

The evaluation puts particular emphasis on the fulfilment of the requirements and intentions in relation to achieve buildings with attractive and creative working environments, a pleasant indoor climate, possibilities to easily adapt the layout to changing organizational needs and with good opportunities for informal contacts across physical and organizational divides. Attempts will be made to clarify what impact the new physical surroundings have on the way DR's organization functions and performs can develop. The satisfaction among staff with the buildings is also investigated.

The results presented here are based on a first and early qualitative evaluation in spring 2007 when only 3 out of 4 segments in the whole complex of DR Byen had been taken into use. The 3 segments were occupied gradually during 2006. The intention is to follow up with further evaluations of both quantitative and qualitative nature. The evaluation is documented in full in a research report in Danish (Jensen, 2007c).

## Method

The interview survey included a total of 18 interviewed people employed by DR. The interviewees were evenly distributed among managers, who all had been involved in the planning of DR Byen, and ordinary members of staff – out of which some had been involved in user groups during the planning of DR Byen and others had not been involved. The interviewees were also distributed among the three segments with most in the very large segment 1 and least in the smallest segment 3. The distribution of the interviewees is shown in table 5.2.1.

	Segment 1	Segment 2	Segment 3
<b>Managers</b>			
• Involved	5	2	2
<b>Staff</b>			
• Involved	3	2	1
• Not involved	1	1	1

**Table 5.2.1** The interviewees distributed among managers and staff and among segments

The interviews were carried out as semi-structured qualitative interviews using an interview guideline with about 60 questions divided in four themes:

- Evaluation of the new surroundings
- User involvement

- The overall process
- The Vision for DR Byen

Questions were as far as possible formulated openly. As a main principle all interviewees were asked the same questions, but questions about the overall process were mostly asked to those who had been involved. In some cases additional questions were asked dependent on the interviewee. Each interview lasted about 1 hour. The interviews were recorded and written minutes were sent to the interviewees for comments and acceptance.

Before the survey, the managers among the interviewees were contacted by mail by DR's client organization with information about the investigation. Afterwards they were contacted by BYG-DTU, and arrangements for the interviews were made. The managers were asked to appoint the members of staff to be interviewed. None of the people contacted refused to participate in the survey.

The 18 interviews took place from 19. March to 16. May 2007, and at the time of the survey people had worked between 4 and 12 month in DR Byen. There was still a huge building site around the occupied buildings, and the Internal Street was not finished, but had just been opened between segment 1 and 2 without any service facilities in operation. In the occupied segments there was still trouble shooting going on both in relation to the building and the technology. Major changes in DR's organization also took place during the period.

However, most importantly, DR went through an economical crisis at the time with severe cuts being announced shortly before the survey, and as a consequence about 10% of the staff was going to be made redundant. The cuts were partly due to budget overruns on the building project – mostly related to the concert hall in segment 4. At some points during the period of the survey strikes occurred among DR's staff as protests against the redundancies.

This situation in the survey period could influence the results negatively. The economical situation has clearly had an impact on the replies to some of the questions, and particularly on those related to the vision for DR Byen concerning the possible effect on DR's broadcasting output. Besides these questions it is the impression that the interviewees mostly have been capable to separate DR's economical conditions from their evaluation of the physical environment in DR Byen and the previous planning process.

## **Results**

The results of the interview survey are presented anonymously. The presentation follows the division in the four themes in the interview questions. The ordinary text presents the general results from all the interviews, and this is supplemented by boxes with citations from some of the interviews. The citations do not necessarily represent the general picture, but have been chosen as remarkable and interesting expressions. They can be typical viewpoints, which deepen or vary the general picture, or they can be more extreme viewpoints showing the width in the replies.

It is indicated in the boxes whether the citations are from a manager or an ordinary member of staff. The reason is not that the division of views in general follows a line between managers and staff. It is only to provide a better background for reading the statements.

#### *Evaluation of the new surroundings*

The overall impression of DR Byen is generally positive. The diversity due to the involvement of four different architects and the transparency and the light in the buildings are emphasized as positive aspects. It is appreciated that everything is new and also that DR has become more united than before. The architecture is also mostly evaluated positive. The newsroom atrium with the open and curved balconies in the western part of segment 2 is regarded as exceptional, but also other atria and high rooms are valued. Segment 3 is evaluated as very well functioning, and segment 2 is also evaluated positive, while segment 1 is seen as the least successful – although mainly by people working in other segments. The expectations for the Internal Street and the concert hall are great.

#### *Managers:*

*"The layout of the building is perfect for the overall purpose"*

*"The western part of segment 2 is an architectural scoop"*

#### *Staff:*

*"The division and layout of the building is fine. It seems like it has been thought through, how things should be placed in relation to each other"*

*"It is pretty, but there is too much glass"*

The workplaces and furniture in general function very well but the working environment is anonymous and impersonal, and some find that there is too little space. The views are very much divided in relation to the open environment. The managers are generally positive, even though they get more disturbed than before, but they are also more accessible for the staff. One of the staff representatives does not thrive at all in the open environment and prefers to work at home as much as possible. The views are also divided whether there has been an increase in knowledge sharing or not, but it is seen as an advantage that people sit closer to each other, and it is easier to see who are present. Another advantage is that more groups and departments have been placed more together than earlier. In spite of problems with trouble shooting for instance in relation to ventilation, light control and sun shades, the indoor climate is mostly evaluated positively. Some mention that the acoustics in the open environment work surprisingly well.

#### *Managers:*

*"The open offices give the manager some possibilities to influence the staff and give a feeling of the general spirit"*

*"Workplaces and furniture functions without any problems, but people make too much mess. Too much old paper culture has moved in"*

#### *Staff:*

*"A library atmosphere has evolved, because everybody is afraid to make noise"*

*"Workplaces functions well, but the furniture is ugly. It is sterile and looks more like a bank or an insurance company – not a media company"*

Most find that there is more contact across the organization in DR Byen than before. Cafés and informal meeting places are used very differently. In segment 1 and 2 the cafés on the 2nd floor are used as meeting places, while the cafés on the other floors only are used as kitchens. Those of the common areas that have been taken into use are generally evaluated positive. The atria are used in varying degrees. The staff restaurant is regarded as boring and has problems with logistics and capacity. The meeting centre in segment 3 functions well, but the architectural quality of the great meeting hall does not live up to some managers' expectations.

*Managers:*

*"The distances are much shorter - both mentally and physically – compared to TV-byen"*

*"The understanding of how to use the common facilities is not developed yet"*

*Staff:*

*"It is more common to stop and talk together, because you see each other all the time. That gives some social benefits"*

It is in general difficult to evaluate the impact of the new surroundings at the moment. It has become easier to change the layout of workplaces. There are some indications, that efficiency has increased, and there is a great potential for increase in productivity, but problems with technology has limited the benefits for those involved in production of radio and TV. The relocation has created a stronger coherence in the organization, and a more united culture has evolved.

*Managers:*

*"The building provides a more appropriate frame for the value DR wants to create, and you can already feel that"*

*"The buildings provide the opportunities for efficiency and stronger focus"*

*Staff:*

*"Projects have more spin-off, because we sit closer together"*

*"People show more social behaviour and use each other more"*

The things that people miss in DR Byen are mostly of intangible character like ambience and atmosphere. From Radiohuset the architecture and the roof garden are missed, and from TV-byen the surrounding facilities are missed. The smoking policy with a total ban on smoking indoor is evaluated as positive and is accepted and followed, but the conditions in the outdoor smoking area are not satisfactory.

*User involvement*

The group based approach has worked well and was in accordance with the culture in DR. The sizes of the groups – maximum 10 in construction briefing and 8 in interior planning - were appropriate. Information exchange with the interior architects has been satisfactory and improved through the process, and the staff was well informed. The in-

puts from the users were implemented in various degrees. The process was mostly characterized by consensus with few conflicts, and differences in views have been handled well. The managers find that they had strong influence, but several members of staff find that the managers were equal partners in the involvement process.

*Managers:*

*"As far as the economy allowed it the users' inputs have had influence"*

*"In the interior planning of workplaces people feel a bit cheated. The rooms restrict to a certain degree how many there can be and the policy on furniture was very restrictive"*

*Staff:*

*"The group based process started fine. We were promised a lot. The closer we came to the move, the more limited the decisions became"*

*"The Involvement has contributed considerable to the final result and it has been well received by the colleagues"*

The amount of staff resources used in the process has in general been on a reasonable level in relation to the outcome of the process. However, some managers feel that too many resources were used in the involvement process, while some members of staff find that the users' possibilities to influence the result were too limited.

*Manager:*

*"The user processes could have been managed more strictly and thereby many resources could have been saved, but it was really good to make the involvement. The same result could have been achieved by a more efficient process."*

*Staff:*

*"We used a lot of energy to decide how to place 75 desks"*

The most important outcome is that the staff has been mentally prepared to move and feels ownership to the final result. Contrarily, a process without user involvement is regarded to have created dissatisfaction, more complaints and greater resistance to changes. Most find that the user involvement has led to buildings that suit the needs of the users better. The user involvement led to a higher degree of motivation among staff during the process, but after the relocation one does not notice any difference in motivation between those who were involved in the process and those not involved.

*Managers:*

*"The closer one has been to the process, the more enthusiasm and motivation there has been"*

*"You do not notice any difference in motivation between people that were involved and those that were not. However, during the process this difference was obvious"*

*Staff:*

*"There has been a difference in motivation among those that were not involved as they did not have the same level of information. But it was good that they knew that their colleagues were represented in the involvement process"*

*"Those that were not involved do not care so much about the facilities"*

In general, there is satisfaction with DR Byen, even though there are differences in the level of satisfaction. Among the interviewees most managers find that there is great satisfaction while some of the members of staff are more uncertain.

*Managers:*

*"There is great satisfaction with the building, and you do not notice any difference in satisfaction among those who were involved in the planning, and those who were not"*

*"The group of people that had individual offices before the move is not satisfied"*

*Staff:*

*"The degree of satisfaction depends on who you talk with. Many complain, but generally people are positive"*

*"Even though there still are some problems with the buildings, I find that there mostly is a general satisfaction with DR Byen"*

*The overall process*

In general there has been a good coherence between the main processes in the planning of DR Byen, although there were some problems with the timing, particularly for the technology. The client organization has been sensitive to the needs of DR's organization, but there have in varying degree been problems in the communication between the different architects and the users. The management of the planning process should have been stricter.

*Managers:*

*"It has been underestimated how long time change processes take"*

*"People have experienced, that rooms were placed differently from where they wanted them"*

*Staff:*

*"There has been good coherence in the processes. The staff was prepared by courses and the interior layout was changed to open plan offices in TV-byen, which also meant that one had to tidy up one's stuff."*

*"The architecture has been more important than functionality"*

*The vision for DR Byen*

Before the interior planning process started DR formulated a vision for DR Byen, which is shown in chapter 3.3.

The views are divided whether a world class multimedia house has been or will be created. Many believe and hope that DR Byen will become a world class multimedia house.

A flexible and open work environment has been created for the users, but the flexibility has not yet been utilized very much. Most of the interviewees also find, that DR Byen provides an inspirational base for collaboration and creativity, or that this will be achieved when the Internal Street is completely finished.

The views are very divided – both among managers and staff – about DR Byen’s impact in relation to DR’s broadcasting output to the Danish people, and the economical situation influences the evaluation considerably. Several find that DR Byen over time will lead to better programmes, and some also think that DR Byen will give more choice.

*Managers:*

*"It is possible to produce better programmes for the same money"*

*"Diversity can create innovation and thereby better programmes. This is easier in DR Byen, which support the movement in digital technology"*

*"It will not mean better programmes, but a better environment has been created. Many other elements are part of the foundation for good programmes; it is not only the buildings"*

*Staff:*

*"The environment in DR Byen will create the elements that are needed to produce better programmes to the Danes"*

*"DR Byen does not in itself lead to better programmes, but we will be able to deliver more for the same money"*

*"At the moment we produce worse programmes due to the cuts – that is not caused by the buildings or the environment. Over time we will be able to create better programmes, because it is a media house where we have the opportunities to work together in all sorts of combinations"*

### **Conclusion and recommendations**

In spite of the economical crisis in DR during the survey period with announcement of cuts and redundancies, and in spite of the trouble shooting going on in relation to both buildings and technology the interview survey shows an overall positive evaluation of DR Byen after occupation by the 9 managers and 9 staff representatives involved in the investigation. The managers are - not surprisingly – the most positive, while the views from staff are more mixed. However, most of the staff representatives are positive and only a few are very critical.

#### *Recommendation for DR’s organization*

DR Byen was defined to be the physical environment for a new way to produce electronic media with focus on creativity and cross organizational collaboration, with possibilities to dynamically change the organization and creation of a new corporate culture as well as a new image based on openness to the surroundings and the public. Before the move great efforts were made to prepare DR’s organization to the new conditions – for instance by user involvement – and it is important to continue this development of the organization to realize the potential, which DR Byen represents. The investigation indicates that the effect on staff motivation from the user involvement is no longer working.

Many expressions from the interview survey support this, for instance:

- *"It has been underestimated how long time change processes take"*
- *"The common areas are mostly used by those who are placed near them"*



- *“The understanding of how to use the common facilities is not developed yet”*
- *“It takes some time before you increase your radius*
- *”When we moved in the motivation and energy was high. When people discovered that they could not work the way that they had expected (due to problems with the technology) the motivation went down”*

It is recommended that DR consciously continues to disseminate the ideas behind DR Byen and create events, activities and learning processes in the organization to make the staff get informed about and experience the opportunities in the buildings, including possibilities to meet across the organization and use the common areas. The managers in DR have a crucial position in this respect, and it is important that all managers have the necessary knowledge, commitment and ability to take the lead in the process.

The thinking behind this recommendation can also be expressed in the following slogan:

*Buildings are passive assets if they are not used actively - it is a management task to start activities that activate the assets*

#### *Recommendation about further evaluations*

This interview survey is a preliminary qualitative evaluation of DR Byen carried out at an early stage when the building project is not completely finished, and the staff has only worked fairly short time in the buildings. Therefore, it is recommended to follow-up with further evaluation of both quantitative and qualitative nature.

The crisis in DR during the survey period of this evaluation makes it even more interesting to see, how the results are in a follow-up evaluation at a later stage, when DR's economy and organization is less turbulent, and the buildings are in a more finished condition.

More specifically it is recommended, that DR carries out a questionnaire survey among all staff to provide a complete quantitative evaluation of the staff's experience and satisfaction with DR Byen. Such a survey could be part of a general survey on staff satisfaction in DR's organization, where the normal questions are supplemented by a number of questions related to DR Byen.

Furthermore, it is suggested to make a more in depth qualitative study implementing a method based on walk-through, which has been developed in the international research project "Usability of workplaces" and tested in case studies of buildings, for instance in Norway and Finland. In this method the researchers take a tour around the buildings together with a group of users, and based on the concrete physical aspects they meet on their way, comments and evaluations from the users are collected in relation to a number of focus points, which are discussed at a workshop after the tour. Based on this the researchers can make an overall evaluation of the buildings in relation to the selected focus points.

## **6. FACILITIES MANAGEMENT ASPECTS**

This chapter on building evaluation includes 2 sections.

Section 6.1 on the origin and constitution of FM Functions in DR is based on chapter 6 in the research report “Real Estate Strategies and Building Value” written in Danish (Jensen, 2006d). The text presented here has been translated and adapted.

Section 4.2 on evaluation of DR Byen is based on parts of an MBA thesis written in Danish (Jensen, 2004). A paper with the title “The organizational relationships between support functions and core business” was presented and published in proceedings from the 6<sup>th</sup> EuroFM Research Symposium” in Zürich in June 2007 (Jensen, 2007b). The text presented here has been adjusted.

### **6.1 The Origin and Constitution of FM Functions in DR**

This section deals with the constitution of Facilities Management (FM) as an integrated corporate function. It looks at how the different functions, which today constitutes a corporate FM function, have originated and developed over time. The purpose is to understand the origin and constitution of FM and the reasons and circumstances behind this historical development of FM.

The paper is based on a longitudinal case study of DR (Danish Broadcasting Corporation) during the 80 years of the corporation’s existence. The focus is the origin and development of the internal functions of building operation and building clients, and the related service functions have developed over time to become an integrated corporate Facilities Management function.

In the analysis distinctions are made on the one side between a horizontal division in building related and service related functions, and on the other side between a vertical division in operational, tactical and strategic functions. The constitution of an integrated corporate FM function involves the integration between those distinct and former separated functions.

The paper starts with a description of the research methods applied and the research aim, followed by a presentation of theory in relation to the constitution of FM. Afterwards the case study is presented as well as the major findings, and finally the results are discussed and conclusions are drawn.

#### **Research method and aim**

The data collected are based on literature studies, archive research and an interview survey. The literature studies have included some theoretical literature on FM organization but mostly concerned publications related to DR’s history from 1925 and onwards including 80 years of annual reports. The archive research has supplemented the empirical literature studies and has included studies of archives at DR’s internal library and archive as

well as archives on some of DR's major building projects at the Danish National Archive (Rigsarkivet). The interview survey has involved 12 interviews with former managers in DR and former consultants for DR.

The research is based on a huge amount of empirical material about the case study. This paper only includes a brief summary of this. In the analysis the theoretical distinctions between building and service related functions as well as operational, tactical and strategic functions have been applied to structure the data and define different phases in the historical development.

The research aims to contribute to the development of a theoretical and empirical understanding of the origin and constitution of FM as an integrated corporate function. The case study methodology gives the possibility to provide an in depth empirical understanding and the theoretical framework helps to order and explain the empirical material in such a way that general hypotheses and testable conclusions can be formulated.

### **Theory on constitution of FM**

There are to my knowledge no other in depth studies of the origin and constitutions of FM and not much theoretical literature to support such studies. There are some attempts to explain why FM has developed in a specific period of time. Becker (1990) points to global competition, development in IT, increasing cost of office space and quality defects as well increased expectations from staff as the reasons for the development of FM as a new discipline. The theories of Porter (1995) on value chain and distinctions between primary and support functions and Hamel & Prahalad's (1994) concept of core competence are often seen as important management theories driving companies to focus on their core business and outsource support functions like FM.

Bröchner (2000) has made an interesting historical study of FM about how the Roman Empire's managed activities related to facilities, although no unified concept of FM or single profession of Facilities Managers existed at the time. The study provides an interesting parallel about the use of outsourcing and contracts in different historic periods, but it does not provide an understanding of the constitution of today's corporate FM functions.

From military thinking and general management theory it has become commonplace to distinguish between operational, tactical and strategic levels of FM. The new European standard on FM Terms and definitions from 2006 includes a model of FM in an appendix with these levels. It is explained that they are levels of interaction between FM and the primary processes in order to synchronize FM provisions with the mission and vision of the organization and its objectives. At the strategic level it is in order to achieve the objectives of the organization in the long term, and at the strategic level it is to implement the strategic objectives in the medium term. At the operational level it is to create the required environment to the end users on a day-to-day basis.

According to Barrett & Baldry (2003), it is critical that FM and corporate strategic management mesh, and the aim of strategic FM is to achieve a strategic fit between core

business needs and the provision of FM. With adaptation from Barrett & Baldry (2003) and Becker (1990) four possible relationships between FM and corporate strategic planning can be described:

- **Integrated strategic FM** with a fully integrated relationship, where a dynamic, ongoing dialogue - both formal and informal – takes place between the corporate strategic planning and strategic FM planning
- **Proactive strategic FM** with a two-way relationship, where the strategic planning takes place in parallel and interdependent at corporate level and in FM with mutual exchange of information
- **Reactive strategic FM** with a one-way relationship, where FM reacts but does not influence the corporations' strategic initiatives
- **Passive non-strategic FM** with only an administrative relationship, where FM provides support but is not involved in the strategic planning process

Jensen (2007) concludes in the study of the organizational relationship between support functions and core business, that the relationship between core business and strategic support is identified as primarily a general business orientation, while the relationship between core business and non-strategic functions is identified as mainly a specific customer orientation. It is concluded that a market relationship – internally or externally – is appropriate for non-strategic functions, while it is important to create a kind of coalition between the core business and the strategic support function.

Within FM it is common to distinguish between building related and service related function. Another similar distinction is between hard FM and soft FM. The new European FM standard expresses that the field of FM can be grouped around client demands, which can be summarized under two main heading – the first being Space and Infrastructure and the second being People and Organization. This distinction resembles the distinction between building and service related functions.

### **Case study findings**

The results of the analyses are divided in the period before and after 1993. That year the integrated FM department was established.

#### *The period from 1928 to 1993*

Table 6.1.1 gives a summary of the development of DR functions related to FM today during the period from 1928 to 1993. The explanation of the table starts at the bottom and is mostly chronological.

During the first years after the start in 1925 DR was located in various rented places around Copenhagen and the organization was very small. The administration was mostly undertaken by the Danish Post- and Telegraph Administration, but in 1928 DR got its own administration. The service staff at that time was limited to 2 messengers (the beginning of a Handling Office) and 1 telephone replier in the evenings.

Year	1928	1940	1964	1970	1974	1988	1993
Building Committee	Established by the Danish Government for Radio House and TV Town						
Internal Client				Building Coordination			
Integrated Management						Building Administration	
Strategic			Administration Office	Building Coordination		Planning and Execution Unit	
Tactical				Administration Office			
Operational		Machine department				Operational Units	
Various Services	Handling Office etc.					Service Administration	

**Table 6.1.1** FM-related functions in DR from 1928 to 1993

Soon after a new building was built next to the Royal Theatre including a new hall for the theatre and the remaining space dedicated for DR was occupied with DR as owner in 1931. This created a need for more service staff with 1 gate keeper, 2 orchestra officers, 1 caretaker and to the technical installations 1 boiler man and 1 assistant. DR has never had its own cleaning staff, and the caretaker was responsible for the management of cleaning provided by an external company.

The decision on the building project was taken by the Danish government based on a proposal from an architect. The government established a building committee to manage the building project, and the committee was chaired by an administrative head of a ministry. Although DR was represented in the committee, DR did not have much influence on the project. The new building turned out to be a major scandal as it was too small for DR's expanding organization and the acoustic insulation between the theatre hall and the radio studios was insufficient.

After a few years it was decided to build Radio House just outside the old city centre in Copenhagen, and a new building committee was established by the government, but this time DR's chairman of the board also became chairman of the building committee, and DR had much stronger control of this project. Radio House was occupied by the beginning of World War II in 1940-41. This caused a strong increase in technical staff for building operation with 4 persons including an engineer. DR also employed a car mechanic in 1938 to maintain the vehicles.

In 1949 the total staff in DR was 234 people and 96 of those were in DR's orchestras. The service staff included 16 people with 9 service related (3 office servants, 3 messengers, 2 gatekeepers and 1 watchman), 4 building related (3 engineers and 1 stoker) and 3 car mechanics. Radio House was planned to be heated by oil, but because of the war it was changed to turf and coal. In the 1950's this was changed to district heating with steam during a major building extension.

The building related function became a separate Machine Department in 1951. In the 1960's a separate Machine department was established in the new TV town in a suburb north of Copenhagen, and another was established in Århus, the next-largest Danish town when a combined Radio and TV-centre was built in the 1970's.

DR did not have any separate functions on tactical or strategic level before the early 1960's. At that time DR's organization had increased considerably to about 1.000 people after having started a second radio channel and not least TV broadcasting during the 1950's. Because of this expansion a special rationalization unit from the Ministry of Finance was given the task to analyze DR's internal processes and organization. The general recommendation was a need to delegate and decentralize the organization.

It was also recommended to establish a new department responsible for activities related to buildings, including maintenance and acquisition of furniture etc. This new Administration Office was established in 1964, and a manager with a background as TV technician in DR was appointed head of the office. Because of an extreme expansion in DR in the 1960's caused by the big success of TV broadcasting, the office got a lot of new tasks. Among these were renting offices and establishing temporary buildings to create workspace quickly enough to accommodate the needs of the expanding organization.

The Administration Office was responsible for tactical and strategic building related activities, but it also expanded in service related activities. It had the responsibility for cleaning and took over the responsibility for office supplies, copying machines, internal printing centre, relocation of staff etc. Earlier DR's staff association had been responsible for a staff restaurant in Radio House, but the responsibility for canteens in all DR's main centres was passed over to the Administration Office.

The Administration Office was also involved in developing new buildings in Jutland, which were needed because of DR's policy to be present around Denmark, but the office was not directly involved in the major new TV Town development. Like for earlier building projects a building committee had been established by the government to manage this huge development. In 1972 the government changed policy on management of state building projects, and this meant that DR got the direct responsibility for their building project.

Around the same time DR had established an internal building client function called the Building Coordination. The new function took over the responsibility for all new buildings in DR and was also responsible for a long term planning of DR's real estate. As such it was a truly strategic building related function. It meant that the Administration Office lost its involvement on the strategic level.

This Building Coordination became part of a unit for planning and rationalization placed at a corporate strategic level under the director general. The reason for creating the Building Coordination was to align the building planning – from identification of needs to beginning of construction – with the long term corporate planning. The head of the Building Coordination was educated as M.Sc. in electronic engineering and had been managing a

TV technical department as well as been involved in the TV Town development from the beginning. He was not accepted for a new management position for radio and television technology, so he suggested that DR should establish the Building Coordination under his management.

This division of responsibility between the Building Committee and the Administration Office did result in some rivalry and competition between the units. Both units worked together with the same architects, but the architectural firm had to have different contact persons to the two units in DR. The architects felt that they had to coordinate DR's building related activities between the two units as they were not capable of creating a working collaboration to do that internally.

A major change in the organization occurred in 1988, which coincided with the time DR lost its monopoly on broadcasting national TV in Denmark. This had been on the way for some years, and the expansion of DR had stopped in the same period. The change can be seen as a need to consolidate the organization, but it was also triggered by the head of the Administration Office reaching the retirement age. The result was the creation of two separate departments for building and service related functions called Building Administration and Service Administration.

The former organization of the building related activities with separate functions on operational, tactical and strategic level was changed to the united and integrated Building Administration. This new department included the three former Machine Departments, which were changed to Operational Units with upgrading of the professional and managerial competences. The Administration office was divided between the Building Administration and Service Administration. In the Building Administration a new Planning and Execution Unit was established on strategic and tactical level with responsibility for real estate planning, building projects, space management and planned maintenance, and this unit was upgraded by supplementing and replacing former staff with a general administrative background with 3 building engineers, 1 architect and 2 technical assistants. The Building Department was managed by the former head of the Building Coordination supplemented by an administrative secretariat.

The Service Administration was formed by the former Handling Office and the other part of the Administration Office, and the former deputy manager of the Administration Office was appointed head of the Service Administration and supplemented by an administrative secretariat.

#### *The period from 1993 to 2005*

Table 6.1.2 gives a summary of the development of DR functions related to FM during the period from 1993 to 2005. The explanation of the table goes from the left to the right.

The years after losing the monopoly on national TV turned out to be very challenging for DR. The new TV2 established by the Danish government as a separate and competing TV station partly based on income from commercials became very successful and managed to get more TV viewers than DR's TV. This caused a major restructuring of DR's

organization in 1993 and involved a first attempt to define DR's core business. The number of directors under the director general was reduced from 5 to 2, leaving only a director for TV and a director for radio, while the former directors for economy, staff and technology were abolished. The shared support functions went through a thorough analysis and were placed either under the TV or radio director according to who was the main user, or kept as shared functions under a new under-director for administration with reference to the director general.

Year	1993	1997	1999	2005
<b>Building Committee</b>			Established by DR's board for DR Byen	
<b>Internal Client</b>			Client Organization for DR Byen	
<b>Integrated Management</b>	DR Service	DR Service	DR Internal Service	DR Service and Administration (SA) DR SA Real Estate  DR SA Estate Operation Distribution, Reception. etc.
<b>Strategic</b>	DR Real Estate Administration	DR Real Estate Service Units	DR Buildings	
<b>Tactical</b>				
<b>Operational</b>	Service Units		Service Units	
<b>Various Services</b>	Distribution, Reception etc.	Distribution, Reception. etc.	Distribution, Reception. etc	

**Table 6.1.2** FM related functions in DR from 1993 to 2005

As part of this process a new shared support function called DR Service was established, which integrated the former Building Administration and Service Administration headed by a new service manager. The former decentralized Operational Units were kept under the new name Service Units together with various specialized service units for Distribution, Reception, Catering and Procurement. The former Planning and Execution Unit was changed to an extended Real Estate Administration on strategic and tactical level.

The reorganization in 1993 also included the introduction of an internal market for a number of service provisions. There were plans also to introduce internal rent, but it was not implemented, and although it has been discussed at later stages as well, it has still not become a reality in DR. Outsourcing of service provisions was also part of the plan and a process to identify service provisions suitable for outsourcing and the procedure to follow was started. The main result was that catering in three canteens was put out for tender and the canteens in Radio House and TV Town were outsourced, while the Canteen in Århus was kept in-house.

Cleaning was also put out for EU tender. Although cleaning always had been provided by external companies, the provision had never been in a real competition. In fact, the cleaning contract on Radio House with ISS had 50 years' anniversary in the beginning of the 1990's. The tenders gave much reduced prices, but the result demonstrated the lack of the maturity in the market. In TV Town the cheapest tenderer explained he had made a mis-



take in the calculations and had to resign and be replaced. In Radio House the cheapest provider could not deliver the defined quality and also had to be replaced after some warnings. However, the cost of cleaning was reduced considerably.

In 1997 a minor adjustment of the organization took place. This involved changing DR Real Estate Administration to a clear strategic function called DR Real Estate and to upgrade the service units as part of preparing them for possible outsourcing. This meant that some of the staff from DR Real Estate Administration was transferred to the Service Units together with the responsibility for minor building projects and maintenance projects. The maintenance planning should take place in collaboration between DR Real Estate and the Service Units.

A major change occurred in 1999 when DR decided to start a relocation of all functions in Copenhagen to a new headquarter and media centre called DR Byen in a new town development in Copenhagen. As part of this process a clearer cut definition of DR's core business was made, and all support functions were placed under a new position as resource director replacing the former under-director for administration. An internal client function was created as a separate unit at strategic level constituted by the former head of DR Real Estate and two others from this unit. DR's board established an internal building committee with members from the board, the director general and the resource director.

The remaining part of FM was reorganized as DR Internal Service under a new service manager with DR Buildings at strategic and tactical level and with the Service Units changed again to pure operational functions, reduced to only one in Copenhagen with responsibility for both Radio House and TV Town and one in Århus. In 2005 the organization was adjusted as part of a general reorganization of the support function as a preparation for the relocation in 2006. The FM activities came under the responsibility of a new manager for DR Service and Administration (DR SA). The name of the strategic and tactical function was changed to DR SA Real Estate, and the name of the operational function was changed to DR SA Estate Operation.

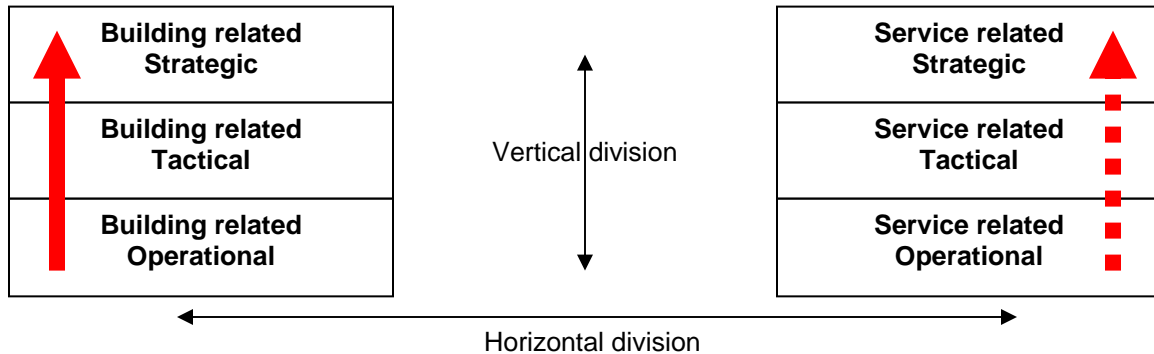
### **Discussion and conclusion**

It is remarkable how the functions develop over time from being purely operational towards becoming steadily more important on tactical and strategic levels. This is particular the case for the building related functions. From 1970 to 1988 there even is a situation where DR has separate functions on operational, tactical and strategic level. This can be seen as a strong **vertical division**.

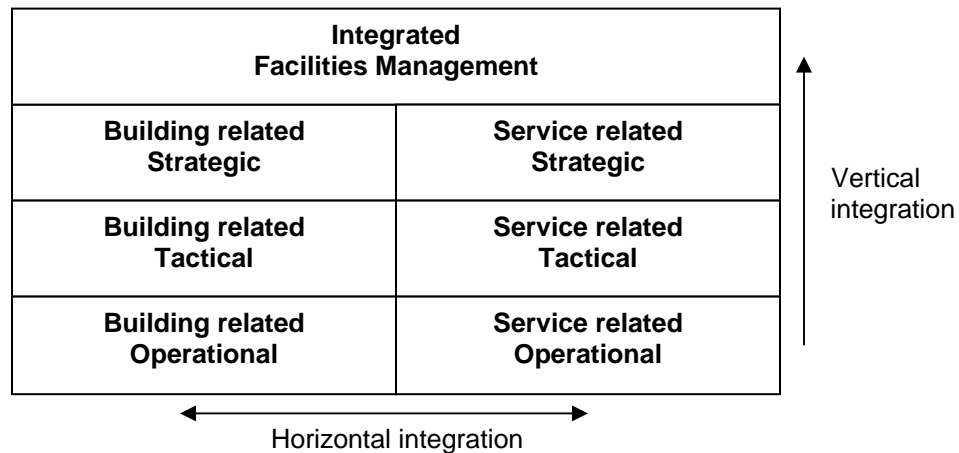
This ended in 1988 with the establishment of the Building Administration and the Service Administration, which unites and integrates the different building related and service related functions, respectively. This coincides with the end of DR monopoly on national TV broadcasting, and DR's long period of almost constant expansion stopped. The new organization in 1988 involved a **vertical integration** of functions on operational, tactical and strategic level.

The separation of the building related and service related functions that existed from the beginning was reinforced in 1988 and can similarly be seen as a strong **horizontal division**. These developments and divisions are illustrated in figure 6.1.1.

The main change occurs when the integrated corporate FM function is established in 1993. This involves a **horizontal integration** and the continuation of the **vertical integration** from 1988 supplemented by an **integrating management function**. This situation is illustrated in figure 6.1.2.



**Figure 6.1.1** The development in building and service related functions 1928-1988



**Figure 6.1.2** The integrated corporate FM function

The reason for establishing the first internal building client function in DR in 1970 was to align the building planning with the corporate long term planning, and the new function was placed as part of a strategic corporate unit. This was a clear example of **integrated strategic FM** and took place during DR's long period of expansion. When the expansion stopped this integrated relation was replaced by a mostly one-way relation and change to **reactive strategic FM**.

During the planning of the relocation and the new headquarters DR Byen from 1999 the relation has changed again. Particularly in the early stage of the planning a very integrated relation was established. When the decision for the new building projects was taken, DR's board of director's launched a comprehensive strategic corporate planning process – the so-called Five Finger Plan - and it involved a strategic briefing of the building project together with projects about DR's future products, production, technology and organization. This was again truly **integrated strategic FM**. Later during the building process the relation became more like a two-way relation with **proactive strategic FM**. This caused some problems with the timely coordination of the changes in DR's production and organization in relation to clarify the needs for the interior layout planning for the building project.

The development in DR clearly shows the need for a coherent strategic planning of the development of the corporation and of the corporate facilities. This is important both for the corporation to achieve its objectives and for the FM function to act proactive and professional. This implies that building client functions in general should be an integrated part of the FM function. In the case of a major relocation it can be appropriate for managerial reason to establish a separate, temporary client function, but in that case it is important to create strong relations between the client organization and the FM function.

The experience from DR shows that it is difficult to create a good working relation between a separate client organization and an FM function, because the units will tend to see each other as competitors and fight against each other to optimize each their influence. Even though they are placed at different levels in the organization, they are still separate, independent organizations without one having authority over the other. When the relocation is finished the temporary client function should be abolished and the staff integrated in the FM function. This can be a very vulnerable process with great risks that key persons leave the organization with a considerable loss of knowledge about the new buildings.

## **6.2 The Organizational Relationship between FM and Core Business**

This section is based on research carried out as part of the work on a MBA thesis at Copenhagen Business School in 2004 (Jensen, 2004). The purpose of the thesis was to analyse and propose solutions for how to organise a strategic support function in relation to DR's core business, when the building project and relocation is complete and the client project organization is dissolved and partly reintegrated into DR's ordinary organization. The background to the research was my concern as to whether it would be possible to maintain interest in issues related to strategic facilities management and real estate among DR's top management after the relocation. This paper will focus on the results of general interest for other organizations. That means that the purpose of the paper is to clarify the organizational relationships between support functions and core business and how these relationships vary for strategic and operational support functions.

## **Methodology**

The research included theoretical reflections on the value chain in relation to FM based on the theory of Michael Porter (1985) and put in relation to DR's organization, which in recent years has been very much developed in accordance with the concept of the value chain of the core business and the distinction between core business and support functions.

The empirical research included an interview survey involving 10 managers in DR. The results of the survey are only presented briefly in this paper and only as far as needed to support the general argumentation.

In the analysis I applied Anna Grandori's (1997) theory of forms of coordination in relation to the degree of centralisation and the number of decision-making parties. I found the concept of coalition of particular relevance in relation to the collaboration between core business and strategic support functions.

## **Value chain analysis**

Michael Porter's (1985) theory of value chains has been very influential over the last 20 years and is also seen as the basis for the development of the concept of FM as a function supporting a company's core business. The new European standard on FM terms and definitions is very much based on this understanding and the standard includes an appendix with a model of FM that clearly reflects this (CEN, 2006).

Porter presents a generic value chain as a big arrow-shaped box divided into primary activities in the bottom half and support activities in the upper half. The pointed right end of the box has a slice marked "Margin". The primary activities are the activities involved in the physical creation of the product, its sale and transfer to the customer, and follow-up, and they are presented as a sequence of typical functions in a production flow: logistics, manufacture, marketing, sales and service. The support activities are activities that support the primary activities and are presented as layers with typical corporate support functions: procurement, technology development, human resource management and corporate infrastructure. Dotted vertical lines crossing the support activities indicate that some support activities support only some of the primary activities while others support all of them.

Porter stresses that the distinction between primary and support activities does not imply a distinction between value-creating and non-value-creating activities. Both primary and support activities are value-creating activities. Porter's purpose in defining the value chain is to analyse the opportunities for companies to create competitive advantages, and both primary and support activities can assist in the creation of competitive advantages.

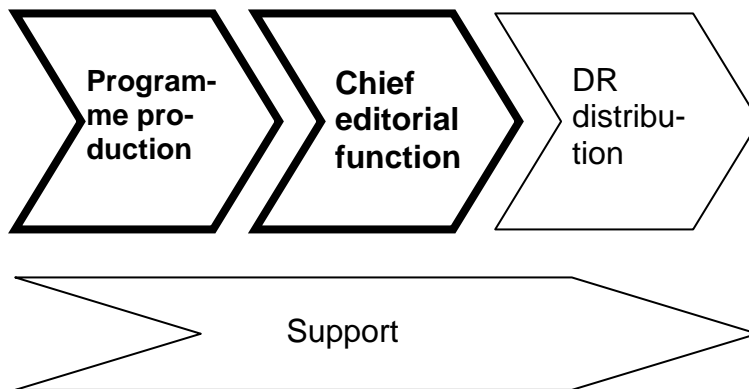
Porter does not mention FM, and buildings are almost non-existent in his written work, a fact also noticed by O'Mara (1999), who has analysed the relationship between strategy and space with inspiration from Porter's theory on strategy. However, in relation to Porter's generic value chain, FM must be seen as covered by support activities. While the

purpose of the core business is to create value in relation to external customers, the purpose of FM is to create value for internal customers by supporting the core business.

Porter defines the value chain internally in a corporation, while theories about supply chain management, as described for instance by Christopher (1998), are concerned with relationships between different corporations. FM support functions are typically carried out as a combination of internal and external provisions, and this means both internal value chains and external supply chains must be taken into account. One of the main issues in supply chain management in relation to FM is the alignment of the internal value chain and the supply chain according to one of the only studies in this field (Nelson, 2004).

### **DR's Value Chain**

DR carried out a strategic planning process in relation to the planning of DR Byen. This included a presentation of DR's value chain as shown in Figure 1. The core business of DR is broadcasting with programme production and the chief editorial function being the primary activities internally, because distribution is divided between a number of external distributors. These primary activities are shown as a sequence in the upper row of arrow shaped boxes in Figure 6.2.1, while all the support functions are included in the lower arrow shaped box.



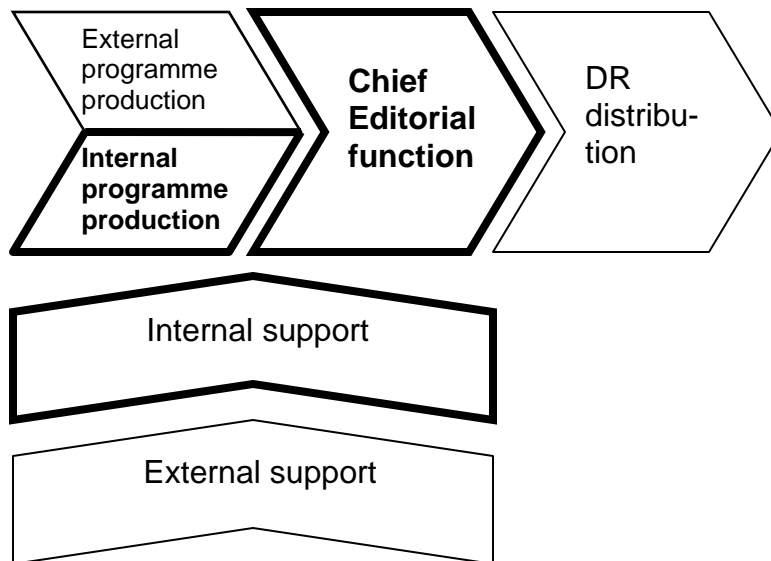
**Figure 6.2.1** The value chain in DR

At the time, DR's organization did not completely reflect the value chain in Figure 6.2.1, but in 2001 the organization was changed to match the value chain. From then on, the chief editorial function included the directorates for television and radio, who procure programmes internally from programme production directorates – one for news and sport and one for other types of programmes – as well as externally. All support was under the responsibility of a resource director and overall management was the responsibility of the director general.

### The Support Value Chain

As described above, not all of the core business activities are undertaken internally. Both distribution and some of the programme production are placed outside DR's organization. The same is the case for the support activities, of course, and one of the general trends in FM is outsourcing of internal activities to outside providers. Because the support activities create value for the internal customers in the core business, it would be more correct or illustrative not to show the support activities as a horizontal arrow parallel to the core business, but as a vertical arrow pointing towards the internal primary activities.

This is shown in Figure 6.2.2, where both internal and external support as well as internal and external programme production is shown. The boxes with bold type show the internal functions (in contrast to Figure 1, where they indicate the internal primary activities).



**Figure 6.6.2** Core and Support Value Chain in DR including external provisions

The internal customers for support activities can be distinguished in relation to the following typical situations:

- The whole corporation is the customer, for instance of common infrastructure
- One single customer represents all the internal demand
- There are a number of internal customers with differentiated requirements

The typical situations in relation to external providers will be:

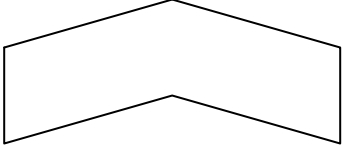
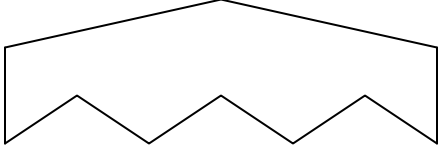
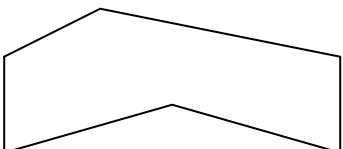
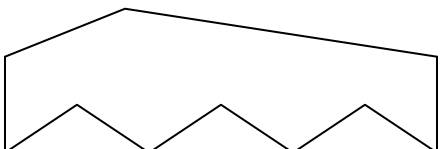
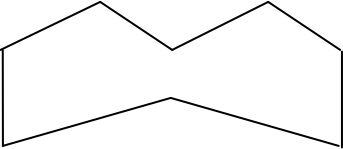
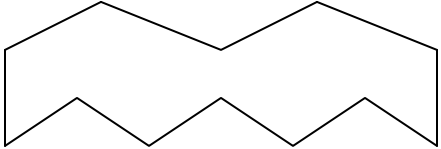
- A single external provider of bundled provisions, where some may be delivered by sub-suppliers

- Several external providers of different provisions, where most normally do not involve sub-suppliers

Based on a combination of the above distinctions between internal customers and external providers, 6 archetypes of supply chains for support functions are shown in Figure 6.2.4.

There are no examples mentioned in Figure 3 in relation to one single customer, because the main example in DR was production support, which was produced internally.

The organizational position of the different types of support function can vary. Provisions to one single customer could be placed together under the same management as the part of the core business that the function supports, as an alternative to being placed together with other support functions. For most other support functions, it will usually be possible to avoid doubling of functions and achieve economies of scale by putting the functions together in a joint support unit. Geographical considerations will also influence the way support functions are organised.

	A single provider	Several providers
Common Infrastructure	 <p>Example: Electricity supply</p>	 <p>Example: Building maintenance</p>
One single customer		
Several customers with differentiated demands	 <p>Example: Internal removals</p>	 <p>Example: Rebuilding</p>

**Figure 6.2.3** Archetypes of support functions related to different supply chains

Management of the relationships between the internal support unit and the internal customers will – according to relational marketing theory (Ford, 2002) – typically be the responsibility of relationship managers or key account managers, while the relationships

between the internal support unit and the external providers should – according to supply chain management (Christopher, 1998) and FM theory (Williams, 1999) – be managed by a professional procurer (informed/intelligent client).

For the internal support unit, it is important to distinguish between business orientation and customer orientation. In relation to common infrastructure, it is necessary to take care of the interests of the whole corporation with a business orientation. A customer orientation towards several different internal customers will run the risk of sub-optimising in the case of common infrastructure. For provisions related to common infrastructure, the corporation should appoint a customer representing the corporation as a whole. This could be a top manager, a strategic function related to the top management, or a board of managers representing the different parts of the corporation.

### **Strategic and non-strategic FM**

Barrett and Baldry (2003) define the aim of strategic FM as to achieve a strategic fit between core business needs and the provision of FM. The precondition for achieving such a fit is a tight linkage between FM and corporate strategic planning. This is in line with O'Mara (1999), who claims that real estate is of no value to a corporation if it does not support the objectives of the business. O'Mara also states that real estate and facilities fulfil two critical roles in relation to supporting the work of an organization and realising its competitive strategy. The first role is to support the production process and the second is to symbolically represent the organization in relation to the surrounding world.

The new European standard on FM Terms and Definitions makes distinctions between strategic, tactical and operational levels (in the appendix describing the FM model mentioned above). The strategic level deals with the long-term objectives and the tactical level deals with the medium-term objectives of the organization, while the operational level creates the required environment for the user on a day-to-day basis (CEN, 2006). Similar distinctions are made in Jensen (2001).

In relation to the earlier mentioned FM provisions, strategic FM is mainly involved with the long-term development of the common infrastructure, the capacity development of the facilities and related services, and defining policies and goals for the FM organization. Non-strategic FM is mainly involved with adapting and delivering the provisions to the customers within the defined policies, strategies and goals.

But while FM really must be regarded as having strategic importance for the organization, it may not necessarily be regarded as such by the top management. According to O'Mara, organizations hate making decisions about real estate, although most big corporations make major decisions about real estate every 3-4 years. It is mainly in situations where such decisions are taken, or major projects or change processes in relation to facilities are being planned, that FM gets attention from top management. So FM can be regarded as a generic strategic field which becomes a current strategic focus area for top management in specific periods – in contrast, for instance, to product and sales development, which has constant attention from top management in most corporations.



### **Inspiration from empirical findings**

One of the ideas behind my research project was to investigate whether the way the building project and technology functions were organised at DR could give inspiration as to how to organise the FM functions. The building project organization was based on a partnering model with the building client, consultants and contractors, which created a kind of coalition between the project managers from the different parties aimed at developing the project towards mutually agreed goals. The project coalition was supervised by a steering committee with a director from each of the companies. The basic idea with the partnering model was to create a win-win situation between the parties instead of each party sub-optimising their individual economical interests at the expense of other parties.

In relation to FM, I saw this model at first as inspiration for the collaboration between the internal FM function and external service providers at an operational level, but as the research developed it became clear that the need of a kind of coalition was more relevant for the collaboration between the internal FM function and the core business organization at a strategic level. The reason for this is that the need for negotiation, coordination and compromise is much greater at the strategic level than at the operational level.

The technology functions in DR were divided into a strategic function, placed as a staff function directly under the director general, and technology departments responsible for projects and technical service under the resource director. A similar model for dividing the FM functions into a separate strategic function under the director general and tactical and operational functions under the resource director was considered. However, such a solution was not regarded as practical for political reasons, because the director general wanted to keep his direct staff to a minimum. Another reason was that, although real estate is a generic strategic area, it would probably not require a current strategic attention from DR's top management once the relocation was finished. Technology in contrast is currently of great strategic importance – not in relation to DR's production but to the distribution of DR's signals, where satellite and digital transmission is under rapid development.

However, another aspect of the organization of technology provided a source of inspiration, because a new type of resource management called IT governance was implemented to ensure a controlled provision and development of IT services internally. The principles of IT governance include:

- That overall rules for the interplay between users and internal suppliers have been established
- That strategies for IT have been defined
- That forums to solve conflicts have been established
- That there is no ambiguity about, who can make and change decisions

In this respect, governance concerns a level of management that is above the project and departmental level and under the level of directors, and it can be seen as the conscious management of areas of strategic importance for a corporation, for instance, resources like IT, staff, finance and property. This concept of governance and the idea of creating a

kind of internal coalition seemed very relevant for strategic FM and caused me to do some additional theoretical literature study on governance and forms of coordination.

### Theoretical reflections

The concept of forms of coordination as a method of managing or governing organizations is based on the theory of transaction economics developed by Williamson (1993) with market and hierarchy as the two basic governance structures. The concept has been further developed by Grandori (1993), who distinguishes between 7 different forms or mechanisms of coordination: price, voting, authority relationships, agent relationships, teams, negotiation, norms/customs. These are regarded as archetypes, and in reality hybrids will often exist.

In Table 6.2.1 I have organised the forms of coordination horizontally according to the degree of centralisation and vertically according to the number of decision-making parties. I have supplemented the 7 forms defined by Grandori with 2 more forms of coordination: alliance and coalition.

Degree of centralisation	Centralised	Semi-centralised	De-centralised
Decision-making			
One-sided	Authority relationship	Agent relationship	Norms/customs
Two-sided	Alliance	Negotiation	Price
Multi-sided	Coalition	Voting	Team

**Table 6.2.1** Forms of coordination related to centralisation and decision-making

One-sided decision-making is equivalent to the internal line organization with a director holding central authority at the top. He makes all important decisions, the implementation of which is often delegated to one or more semi-centrally placed management levels via agent relations down to the individual employees, who can make de-centralised decisions within a limited scope based on norms and customs.

Two-sided decision making is the typical relationship between a customer and a supplier, where de-centralised decisions can be taken based on price alone in the most simple cases, while more complex transactions require negotiation based on several factors besides price and involving semi-centrally placed management at some level. A more long-term alliance relationship can be established between two parties and this will usually involve the centrally placed top management from both parties.

Coordination of multi-sided decision-making at a de-centralised level can be done in teams working together and involving all parties. Voting is mainly related to political and other voluntary organizations and can take place at several levels, including the semi-

centralised level. Multi-sided decision-making involving several organizations or sub-organizations can be coordinated by the creation of a coalition involving more or less centrally placed representatives from each organization. Grandori does mention coalitions in a discussion on cross-company organizations. A consortium is one type of coalition which is usually managed by a forum with a representative from each of the involved companies. Such a forum can easily run into difficulties in achieving agreement as each party has an equal power position. So a governing committee with centrally placed top managers from each party may be needed to resolve conflicts.

In spite of the above examples, Grandori emphasises that all forms of coordination can be used both internally in a company and in cross-company collaboration.

### **Conclusion**

For FM provisions with a differentiation in relation to various internal customers, decentralised decision-making seems to be the obvious solution. That is particularly the case where the quality of the provision is easily defined and understood by both parties, and in those cases price seems to be the best form of coordination. Examples of this could be cleaning, catering, internal removals, hiring of conference rooms, and procuring of standard products. For more complex provisions with the need for dialogue about specific customisation, more centralised decision-making may be needed involving negotiation between managers at some level. Space management issues, like rebuilding projects and workplace design, could be typical examples.

But for decision-making related to strategic FM, it is important to create a close collaboration and alignment between the FM organization and the core business to achieve the necessary business orientation. Such collaboration could take the form of a coalition managed by a forum of representatives from FM and the different parts of the company. In the case of conflicts and disagreements, the company board of directors could act as a steering committee. Other ways of organising such collaboration could be found. My main argument is that in the case of strategic FM a business orientation and a close relationship to the core business is necessary because decision-making needs to be on behalf of the corporation as a whole, taking into consideration its general interests.

## REFERENCES

- Alexander, K. (ed.) (2005): *Usability of Workplaces. Report on Case Studies*. CIB. Rotterdam
- Andersen, Jan & Hans Keiding (1997): *Introduktion til Nationaløkonomi*. Jurist- og Økonomforbundets Forlag.
- Barrett, Peter & Baldry, David (2003): *Facilities Management Towards Best Practice*. Second Edition, Blackwell Publishing.
- Barrett, Peter & Stanley, Catherine (1999): *Better Construction Briefing*. Blackwell Science.
- Becker, Franklin (1990): *The Total Workplace – Facilities Management and the Elastic Organization*. Van Nostrand Reinhold. New York.
- Blyth, Alastair & Worthington, John (2001): *Managing the Brief for Better Design*. Spon Press. London.
- Boligministeriet (1995): *Bygningsreglement 1995*. København.
- Boplan (2003): *Tilgængelighed for dig og mig*.
- Briner, Wendy, Geddes, Michael & Hastings, Colin (1991): *Projektlederen*. Svenska Dagbladets Förlag, Stockholm.
- Bröchner, Jan (2001): *Facilities Management 2000 Years Ago*. Proceedings from World Workplace Europe 11.-13. June 2001. Glasgow.
- CEN (2006): *Facilities Management – Terms and definitions*. EN 15221-1
- Center for Ligebehandling af Handicappede (1996): *Bygningsreglement 1995 – Om tilgængelighedskravene*. København, december 1996
- Christoffersen, Anders Kirk (2003): *Værdiledelse - State-of-the-Art Rapport*. Working Party on Value Management. Byggeriets Evaluerings Center. August 2003.
- Christopher, M. (1998), *Logistics and Supply Chain Management – Strategies for reducing Costs and Improving Service*. Biddles Ltd.
- Cook, Harry (1997): *Product Management - Value, Quality, Cost, Price, Profit and Organization*. Chapman & Hall.
- Danish Disability Council, The (2002): *Danish disability policy Equal opportunities through dialogue*. Copenhagen, April 2002.
- Dansk Standard (1995): *Udearealer for alle – Anvisning for planlægning og indretning med henblik på handicappedes færden*. DS-Håndbog 105.
- Dansk Standard (1999): *Rekreative arealer for alle - eksempelsamling*. DS-Håndbog 105:2.
- Dansk Standard (2001): *Tilgængelighed for alle*. DS 3028:2001.
- Dansk Standard (2003): *Safety rules for the construction and installations of lifts – Particular applications for passenger and good passenger lifts – Part 70: Accessibility to lifts for persons including persons with disability*. DS/EN 81-70.
- Davies, Gerald (1995): *Serviceability Tools – Volume 1. Methods for Setting Occupant Requirements and Rating Buildings*. International Centre for Facilities. Canada.
- DR (2000): *Den fysiske indretning af DR Byen*. Rapport fra analysegruppe E, 20. oktober 2000.
- DR Byen (2002): *Procesplan for indretningsprocessen*. Revideret udgave, 15. december 2002.

DR (2003a): *Indretning af DR Byen*. Direktionens ledelsesudmelding af 10. marts 2003.

Bilag til DR Byen (2003b)

DR Byen (2003b): *Håndbog til indretningsgrupperne*. 3. udgave.

DR Byen (2006): *Status for miljø i DR Byen – miljø, energi, indeklima og arbejdsmiljø. Miljøredegørelse 2005*. 4. maj 2006.

Duffy, Francis (1994): *The new office*. Conran Octopus. London.

ETSI (1998): *Human Factors (HF); Telecommunications keypads and keyboards; Tactile identifiers*. Standard ES 201 381.

Engwall, Mats (1995): *Jakten på det effektive projektet*. Thomson Fakta AB.

Engwall, Mats (2002): *Implementation eller innovation*. Kapitel 6 i Danielsson, Albert & Holmberg Ingall (red.): *Lederskabets olika skepnader - eksemplet Hallandsås*. Studentlitteratur.

Ford, David (ed.) (2002), *The Business Marketing Course – Managing in Complex Networks*. John Wiley & Sons, Chichester.

Fox, M., Hummelshøj, R.M. and Toft, K. (2006): *Optimal Indoor Climate in an Energy Conscious Manner*. Paper for Healthy Buildings, Lisboa 4.-8. June 2006.

Fristedt, Sven & Ryd, Nina (2004): *Att lyckas med program – Kontinuerligt programarbete för bättre styrning av byggnadsprojekt (To succeed with brief – continuous briefing for better building project management)*. Arkus, Stockholm.

Frøbert Jensen, J. and Beim, A., (2003): *Synliggørelse af kvalitet i boligbyggeri. En pilotundersøgelse af forskellige aktørers opfattelse af standard og kvalitet i boligbyggeriet*. Statens Byggeforskningsinstitut. Hørsholm.

Graeber, David (2001): *Towards an Anthropological Theory of Value - The False Coin of Our Dreams*. Palgrave.

Granath, Jan Åke (2001): *Architecture – Participation of users in design activities*. Chalmers Tekniska Högskola (<http://www.fm.chalmers.se>).

Grandori, A. (1997), *Governance Structures, Coordination Mechanisms and Cognitive Models*. The Journal of Management and Governance. 1: 29-47, 1997.

Green, Stuart D. (1996): *Smart Value Management: A Group Decision Support Methodology for Building Design*. University of Reading. England.

Hamel, Gary & Prahalad, C.K. (1994): *Competing for the Future*. Harvard Business Scholl Press.

Hansen: G.K., Haugen, T.I., Jensø, M., Knudsen, W. And Tennebø, K. (2005): *Case study: Nord-Trøndelag University College, Nylåna, Røstad*. In Alexander (2005).

Harpe, Lennart B. (2005): *Development of facility concepts within a perception economy*. Proceedings from the European Facilities Management Conference EFMC 2005 in Frankfurt, Germany. VDE Verlag, Berlin, Offenbach.

Hatch, Mary Jo (1997): *Organization Theory - Modern, Symbolic and Postmodern Perspectives*. Oxford University Press.

Himanen, Mervi (2003): *The Intelligence of Intelligent Buildings. The Feasibility of the Intelligent Building Concept in Office Buildings*. Doctoral Thesis. VVT Building Technology. Espoo, Finland.

Jensen, Per Anker (2001): *Planning Broadcasting Facilities for the 21<sup>st</sup> Century* Proceedings from World Workplace Europe. 17.-19. June 2001. Innsbruck.

Jensen, Per Anker (2002): *Byggeri – fra vision til ny virkelighed (Building – from vision to new reality)*. Forlaget Tegl, Copenhagen.

- Jensen, Per Anker (2003): *Værdi og værdiskabelse i byggeprocessen*. Unpublished MBA study report. Available in Danish by contact to the author by e-mail pje@byg.dtu.dk.
- Jensen, Per Anker (2004): *Organisering af strategiske supportfunktioner i DR*. MBA dissertation.
- Jensen, Per Anker (2005a): *Value concepts and value based collaboration in building projects*. In *Proceedings of CIB W096 Architectural Management*. BYG-DTU, Kgs. Lyngby.
- Jensen, Per Anker (2005b): *Designing for Disability – A Danish Case Study on DR Byen*. In *Proceedings of CIB W096 Architectural Management*. BYG-DTU, Kgs. Lyngby.
- Jensen, Per Anker (2006a): *Håndbog i Facilities Management*. 2. edition. Danish Facilities Management Association, Taastrup.
- Jensen, Per Anker (2006b): *Continuous Briefing and User Participation in Building Projects*. In *Proceedings of the joint CIB, Tensinet, IASS International Conference on Adaptability in Design and Construction*. Eindhoven University of Technology, Netherlands, 3.- 7. July 2006, vol. 3.
- Jensen, Per Anker (2006c): *Strategy and Space for Broadcasting Facilities*. In *Proceedings of CIB W070 Facilities Management and Maintenance*. NTNU, Trondheim.
- Jensen, Per Anker (2006d): *Ejendomsstrategier og bygningsværdier*. Research report R-138, BYG-DTU.
- Jensen, Per Anker, Nielsen, Kjeld, Nielsen, Susanne Balslev (2006): *Facilities Management – Eksempler på god praksis fra de nordiske lande*. Research report R-145, BYG-DTU.
- Jensen, Per Anker (2007a): *General managers' and building managers' different evaluation of building value and quality - as built and over time*. Proceedings from CIB World Congress in Cape Town, 14.-17. May 2007.
- Jensen, Per Anker (2007b): *The Organizational Relationships between Support Functions and Core Business*. Proceedings from 6th EuroFM Research Symposium. EFMC 26.-27. June 2007. Zürich.
- Jensen, Per Anker (2007c): *Evaluering af DR Byen efter indflytning*. Research report R-173, BYG-DTU.
- Jensen, Per Anker, Nielsen, Kjeld, Nielsen, Susanne Balslev (2007d): *Facilities Management Best Practice in the Nordic Countries – 36 cases*. DTU (forthcoming).
- Jensø, Monica (1999): *Brukermedvirkning i byggeprocessen*. Diplomoppgave. NTNU. Trondheim
- Kelly, John & Male Steven (1993): *Value Management in Design and Construction*. E & FN SPON. 1993.
- Kernohan, D., Gray J., Daish, J. with Joiner, D. (1992): *User Participation in Building Design and Management*. Butterworth Architecture, London.
- Klakegg, O.J., Hansen, G.K. & Ramstad, L.S. (1999): *Organisasjonsutvikling og byggeprosess – samspillet i virksomhetsutviklinga*. SIB rapport. Trondheim.
- Klammt, F. (1998): *How are your Facilities Performing?* In *Proceedings from World Workplace – Europe, EuroFM/IFMA Conference in Maastricht, Netherlands*, p. 70-80.
- Konstruktøren (2007): *Cool køling*. Artikel i fagtidsskriftet Konstruktøren, nr. 1, 2007.
- Koskela, Lauri (2000): *An exploration towards a production theory and it's application to construction*. VTT – Technical Research Centre of Finland, Espoo 2000.
- Lawaetz, Jens Fr. (1951): *Fjernsyn*. Jespersen og Pios Forlag. Copenhagen.

- Multiconsult (2000): *Tilstandsanalyse som grunnlag for verdifastsettelse*. Multiconsult A/S, Oslo.
- Multiconsult (2006): *Strategic Building Analysis*. Multiconsult A/S, Oslo.
- Nelson, M.-M. (2004), *The Emergence of Supply Chain Management as a Strategic Facilities Management Tool*. In Alexander, K., Atkin, B., Bröchner, J. and Haugen, T. (Ed.), *Facilities Management – Innovation and Performance*. Spon Press, London and New York, pp. 83-94.
- Nissen, Christian S. (2007): *Generalens veje og vildveje - 10 år i Danmarks Radio*. Gyldendal.
- Nutt, Bev (1993): *The Strategic Brief*. Facilities, Vol. 11, No 9.
- O'Mara, Martha (1999): *Strategy and Place – Managing Corporate Real Estate and Facilities for Competitive Advantage*. The Free Press.
- Pine, B. Joseph & Gilmore, James H. (1999): *The Experience Economy - Work is Theatre and Every Business a Stage*. Harvard Business School Press.
- Porter, Michael (1985): *Competitive Advantage – Creating and Sustaining Superior Performance*. Free Press.
- Preiser, W.F.E. (1989): *Building Evaluation*. Plenum Press, New York.
- Ramírez, Rafael & Johan Wallin (2000): *Prime Movers - Define Your Business or Have Someone Define it Against You*. John Wiley & Sons, Ltd.
- Regeringen (2003): *Handlingsplan for handicapområdet*. Februar 2003.
- Rødsgaard, Bente (2005): *I Operaen er kørestolsbrugere velkommen*. Handicap-nyt. April 2005.
- Sarasoja; Anna-Liisa, Gibler, Karen M. & Leväinen, Kari (2004): *Value adding attributes of CREM*. 11<sup>th</sup> Annual European Real Estate Society Conference, Milan, Italy. June 2<sup>nd</sup> to 5<sup>th</sup> 2004.
- Szigeti, F. and Davies, G., (2005): *Performance Based Building: Conceptual Framework*. Final Report. ([www.pebbu.nl](http://www.pebbu.nl)).
- Teece, David J. (2003): *Dynamic Capabilities: Retrospective and Prospective*. Paper presented at a guest lecture at Copenhagen Business School, 2. September 2003.
- Thyssen, Ole (2002): *Værdiledelse - om organizationer og etik*. Gyldendal. 3. edition.
- Toft, Kaj (2005): *Development of sustainable broadcasting facilities*. Paper i proceedings fra Europæisk Facilities Management conference i Frankfurt, 19.-21. April 2005.
- United Nations (1994): *Standard Rules on Equal Opportunities for Persons with Disabilities*. New York.
- U.S. Department of Labor (1991): *The Americans with Disability Act*.
- Verzuh, Eric (ed.) (2003): *The Portable MBA in Project Management*. John Wiley & Sons, Inc.
- Wandahl, Søren (2002): *Værdibaseret samarbejde - Processtyring skaber højere produktværdi for alle*. Aalborg University.
- Wikipedia (2007): *Project Management*. [en.wikipedia.org/wiki/Project\\_management](http://en.wikipedia.org/wiki/Project_management). Looked up on 8. August 2007.
- Williams, Bernard (1999a), *Facilities Economics*. Building Economics Bureau Limited, Kent.
- Williams, Bernard (1999b): *Benchmarking Quality and Risk*. In *Facilities Management UK*.

- Williams, Bernard (2000): Measuring Quality. In *Private Finance Initiative Journal*, Volume 5, Issue 1.
- Williamson, O. (1993), *The Economic Analysis of Institutions and Organizations – In General and in Respect to Country Studies*. OECD. Working Papers. No. 133.
- Winch, Graham M. (2002): *Managing Construction projects - An Information Processing Approach*. Blackwell Science, Ltd. Oxford.



